

# Writing a training loop from scratch

[https://www.tensorflow.org/guide/keras/writing\\_a\\_training\\_loop\\_from\\_scratch](https://www.tensorflow.org/guide/keras/writing_a_training_loop_from_scratch)  
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## Import libraries

```
In [1]: # Python libraries
import os
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

# Plotting
from datetime import datetime
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
from ipynb.fs.defs.myfun_load_dataset import *
from ipynb.fs.full.myfun_models import *
from ipynb.fs.full.myfun_nn import *
from ipynb.fs.full.myfun_opt import *
from ipynb.fs.defs.myfun_plot import *
```

2023-08-28 18:14:35.572661: 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"
merged_df, dflist = load_dataset(dir_name, 'post')
```

Get  $v_0$  mean over each df looping on dflist

```
In [3]: # params
NUM_EPOCHS = 200
LEARNING_RATE_NN = 0.1
LEARNING_RATE_v0 = 0.5
flag_print = True
flag_save = True

# Create the model NN
DOE = [[1,2,1], [1,4,1], [1,10,1]] #Design of experiment

dataset = dflist
```

```
In [4]: import time

v0_DOE = []

for DOE_struct in DOE:

    model = create_model(DOE_struct)

    print("\n\n")
    model.summary()
    print_train_vars(model)

    print("=="*30)
    s = '-'.join(str(x) for x in DOE_struct)
    print(f"NN structure: {s}")

#v0_mean_list = []
v0_dflist = []

start_time2 = time.time()

for df in dataset:

    v0 = 30
    start_time1 = time.time()

    print("=="*30)
    print(f"In df n.{df['N. file'][0]}/{len(dflist)} we have {len(df)} rows")
    print("=="*30)
    info_df = solve_nn_df(df, model, v0, NUM_EPOCHS, LEARNING_RATE)

    v0_list = [l[1] for l in info_df]
    v0_mean = np.array(v0_list).mean()

    v0_df = pd.DataFrame({'v0_list': v0_list,
                          'n_scn': len(df),
                          'N. file': df['N. file'][0]})

    v0_dflist.append(v0_df)

    print(f"\nv0_mean in this df is: {v0_mean}")
    print("Time taken: %.2fs" % (time.time() - start_time1))

    print_train_vars(model)

    print("=="*30)
    time_taken=time.time() - start_time2
    print(f"To complete the dataset with NN structure: {s} we spent: {time_taken}s")

    v0_DOE.append([DOE_struct, v0_dflist, time_taken])
```

Model: "sequential"

Layer (type)	Output Shape	Param #
Hidden-Layer-1 (Dense)	(None, 2)	4

Output-Layer (Dense)

(None, 1)

3

=====

Total params: 7  
Trainable params: 7  
Non-trainable params: 0

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Hidden-Layer-1/kernel:0: [ 0.67382 -0.8069699]  
Hidden-Layer-1/bias:0: [0.7190728 0.8787124]  
Output-Layer/kernel:0: [0.576622 0.75332713]  
Output-Layer/bias:0: [0.21157598]

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NN structure: 1-2-1

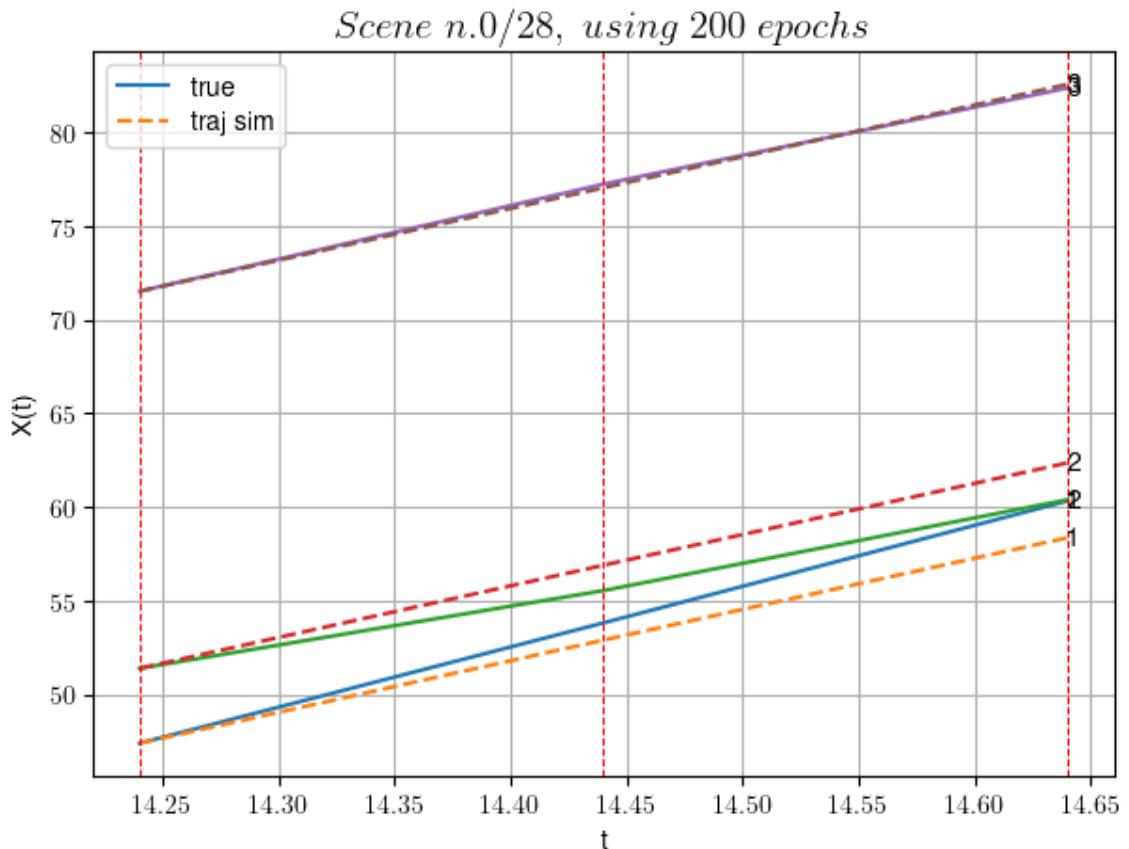
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In df n.1/10 we have 28 scenes

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Scene n.0/28, time interval:[14.24,14.64]

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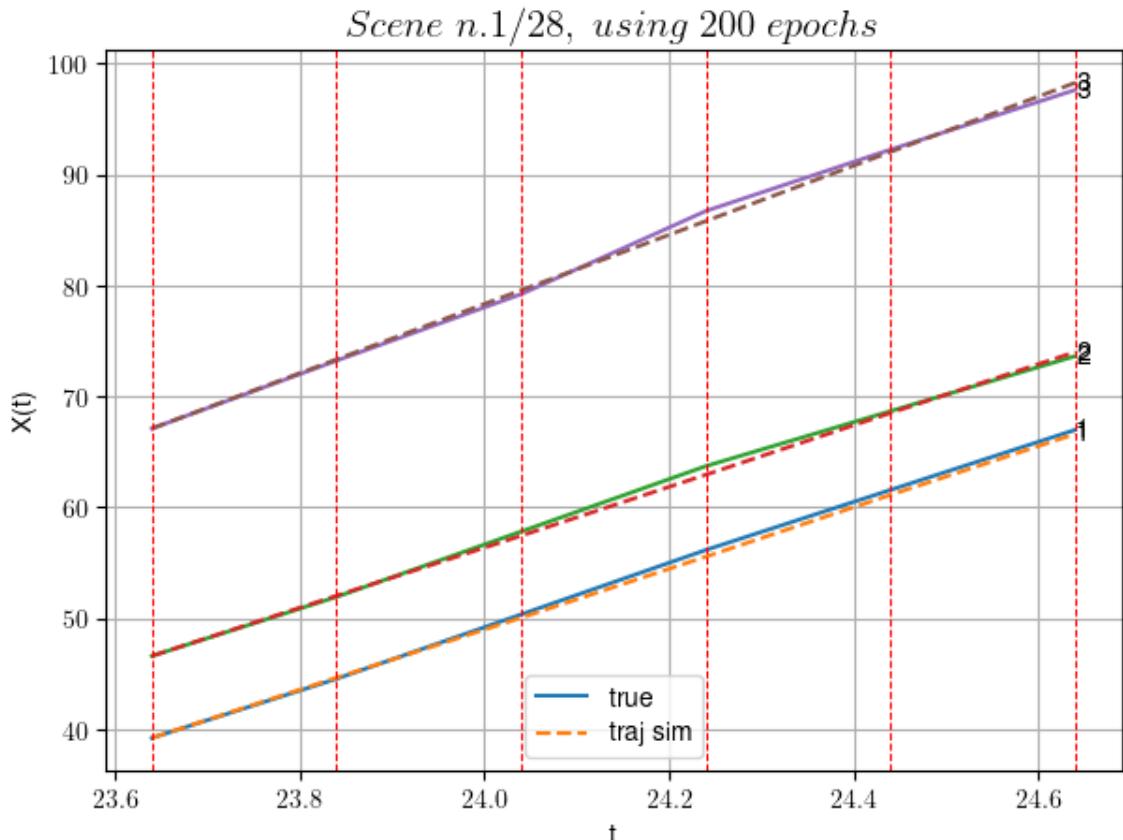
Loss: 1.1669155248630056

v0 updated: 27.638873683178705

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Scene n.1/28, time interval:[23.64,24.64]

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Loss: 0.17461963417344883  
v0 updated: 31.183120056293088

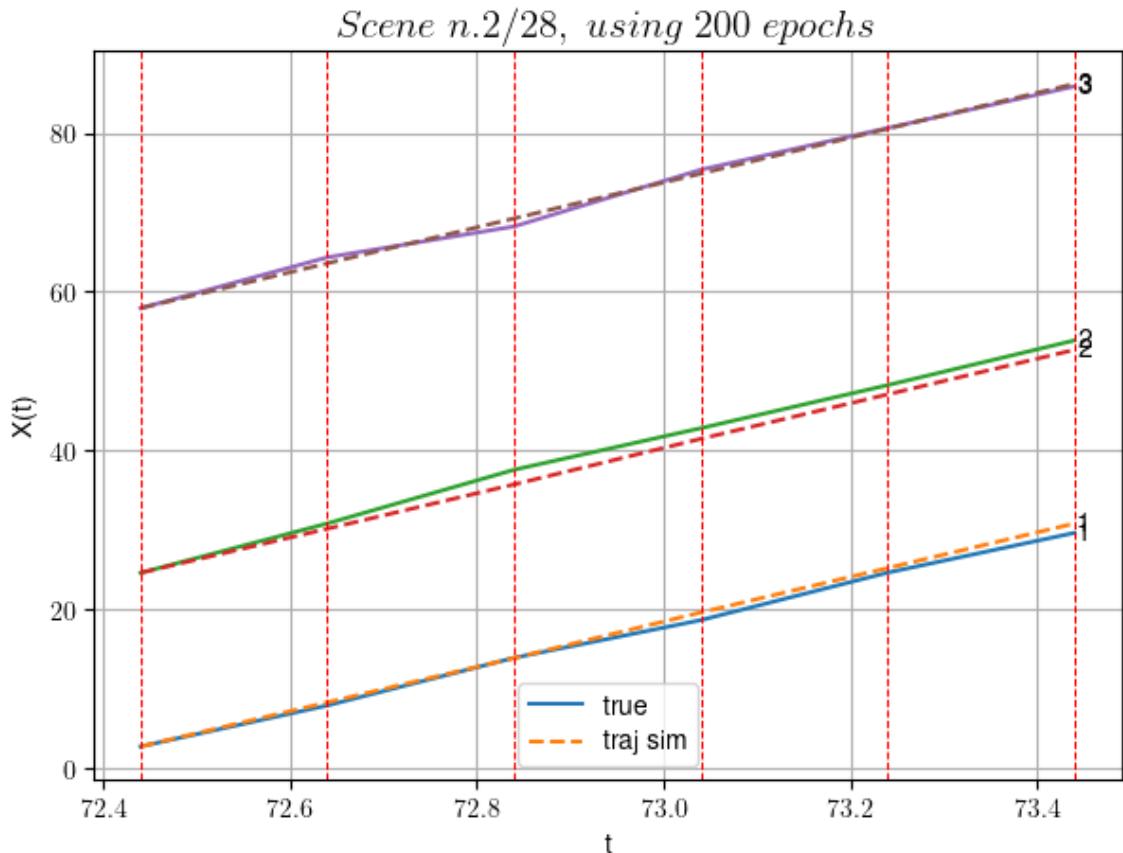
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Scene n.2/28, time interval:[72.44,73.44]

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Loss: 0.7298870677744008  
v0 updated: 28.25284108639968

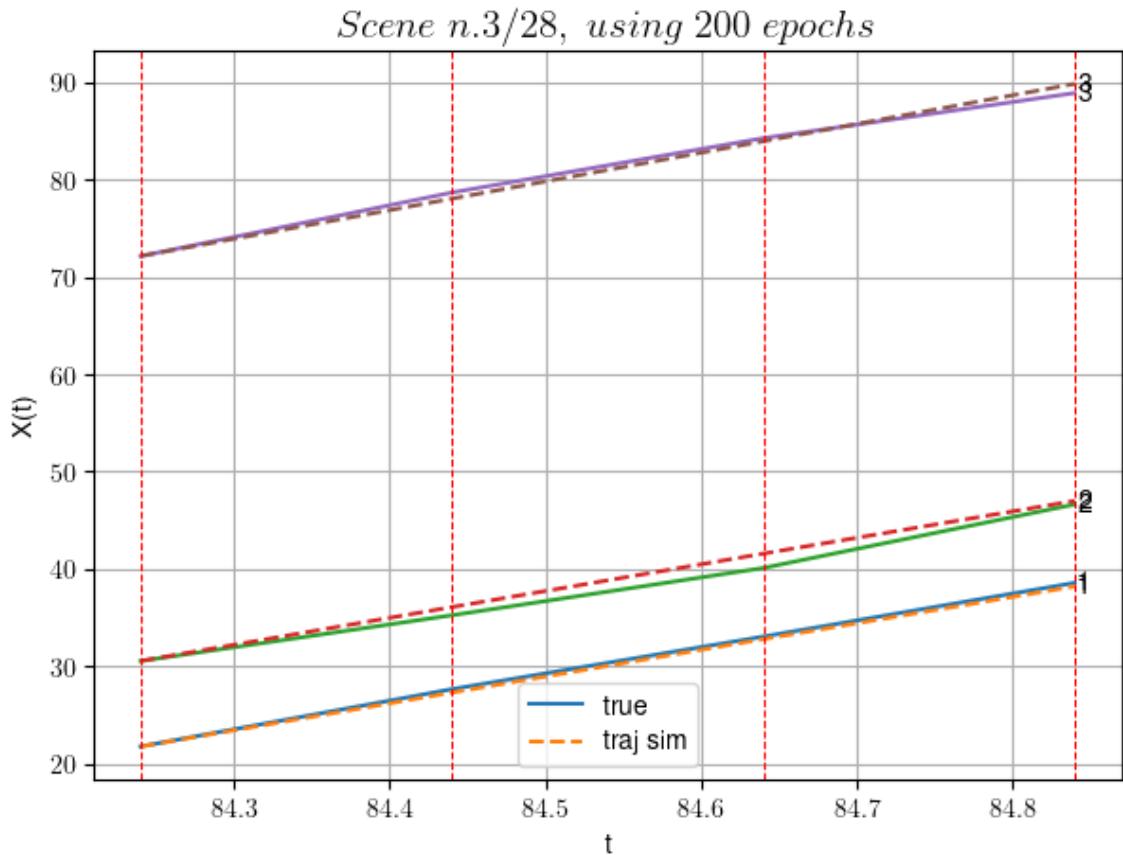
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Scene n.3/28, time interval:[84.24,84.84]

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Loss: 0.3949290128852662  
v0 updated: 29.49492078688976

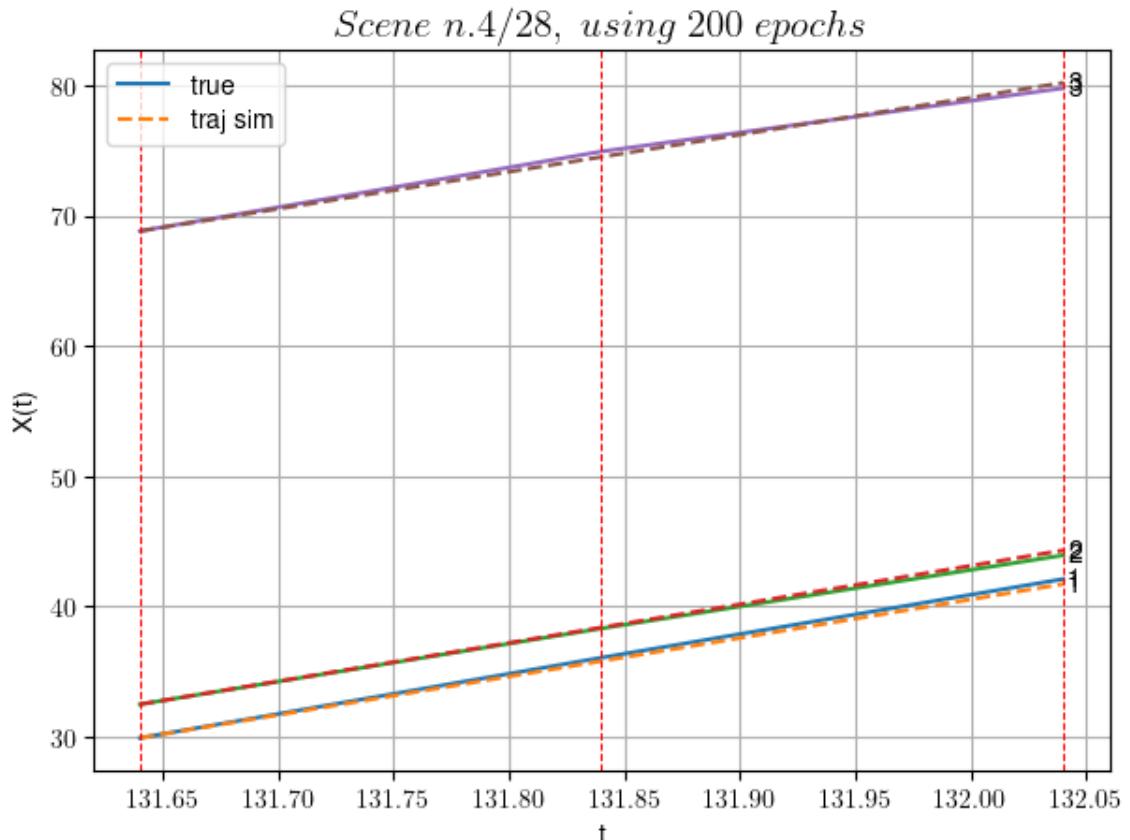
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Scene n.4/28, time interval:[131.64,132.04]

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Loss: 0.07871141595235909  
v0 updated: 28.44460242678685

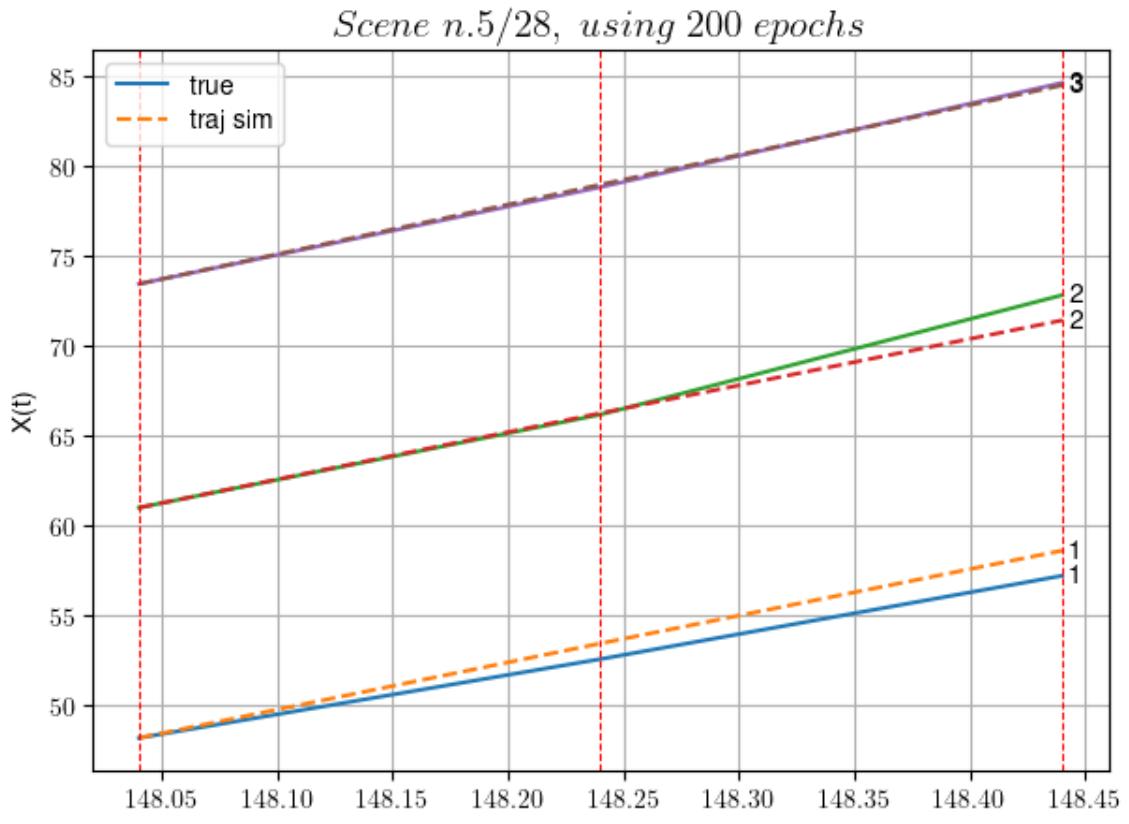
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Scene n.5/28, time interval:[148.04,148.44]

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Loss: 0.5249261951740155  
v0 updated: 27.624268173797052

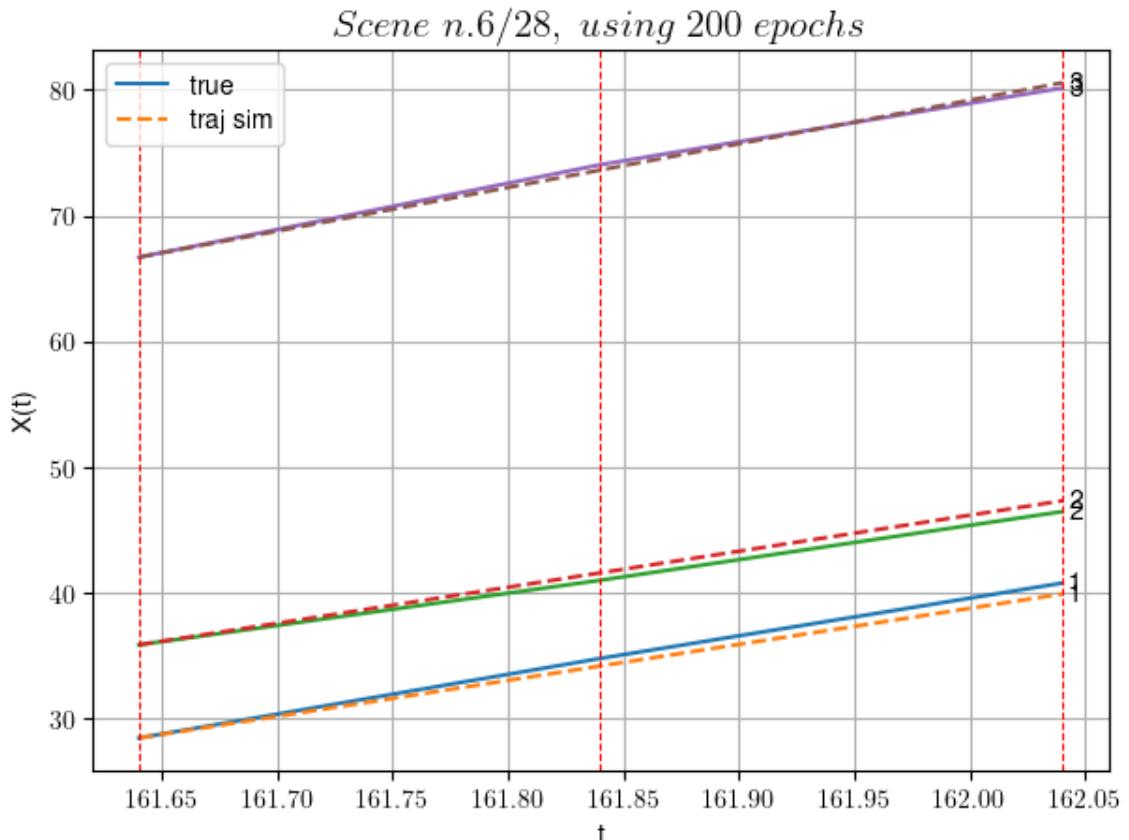
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Scene n.6/28, time interval:[161.64,162.04]

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Loss: 0.2837752361202915  
v0 updated: 34.70664156222626

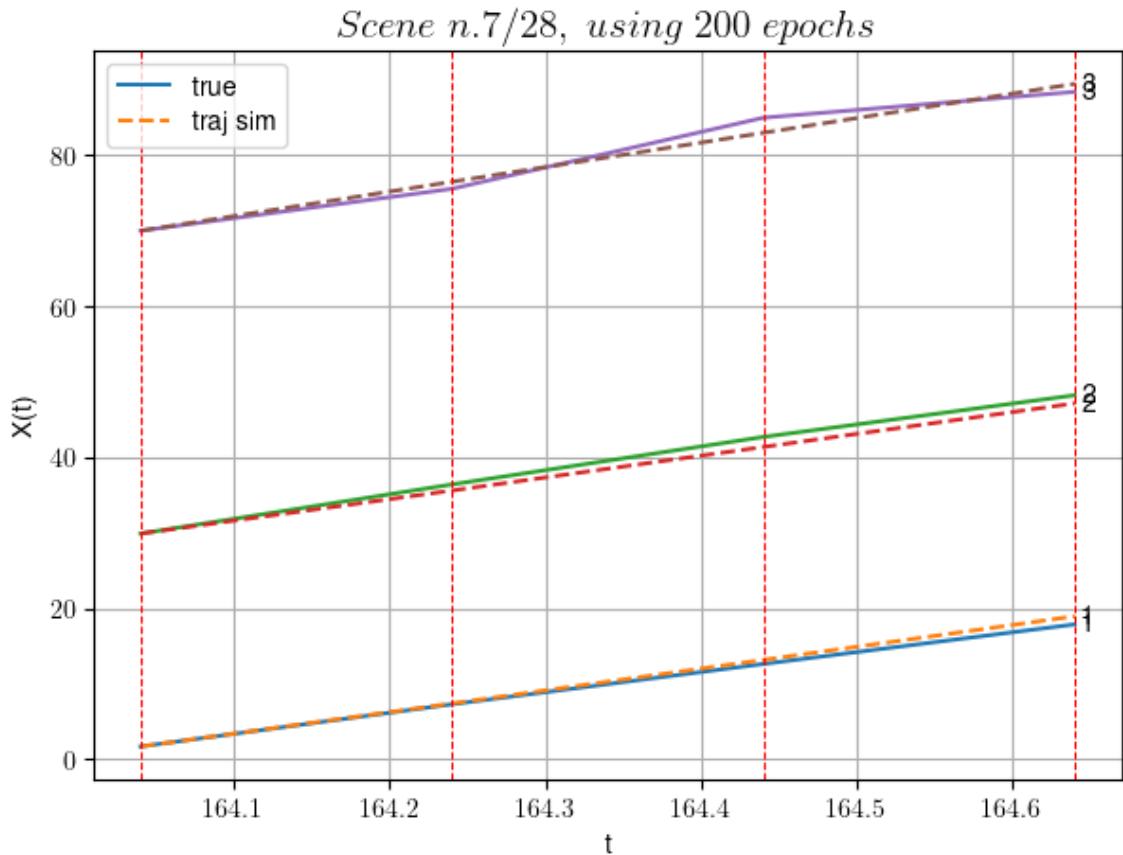
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Scene n.7/28, time interval:[164.04,164.64]

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Loss: 0.9151555496824949  
v0 updated: 32.430179643519104

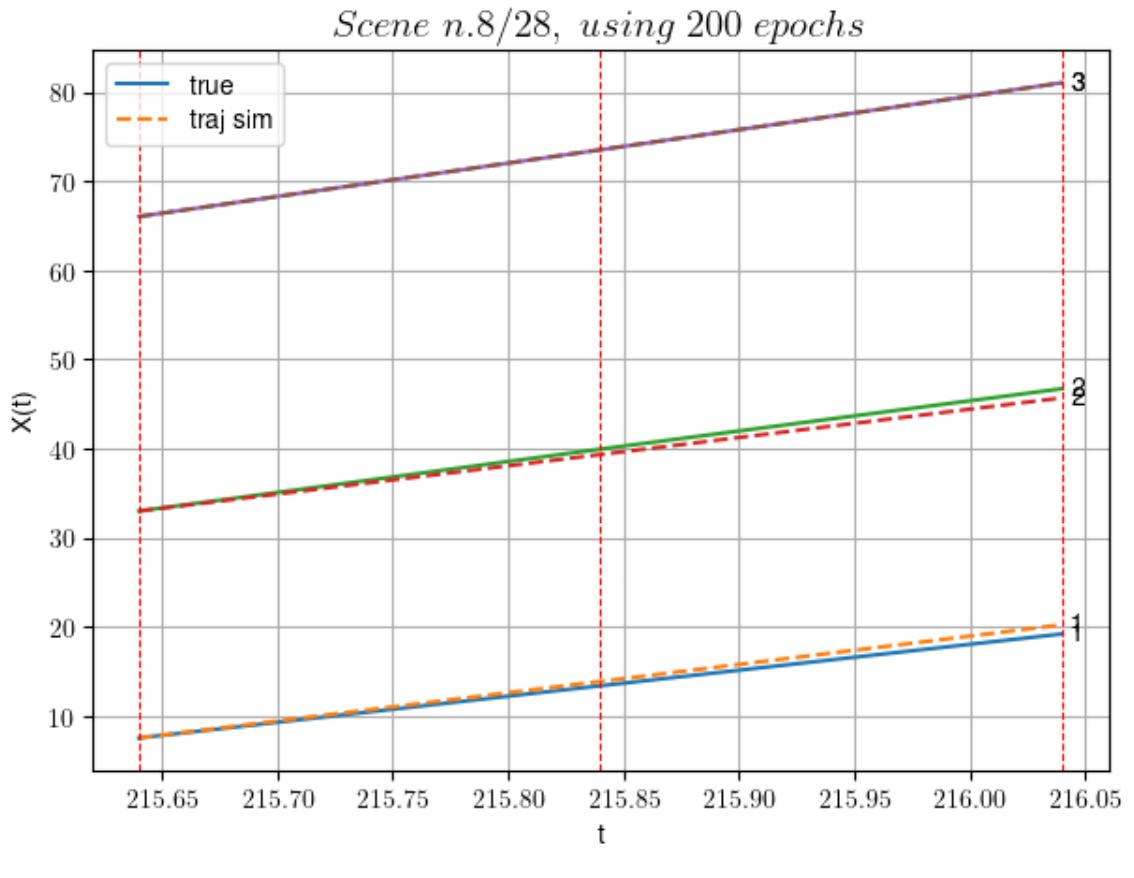
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Scene n.8/28, time interval:[215.64,216.04]

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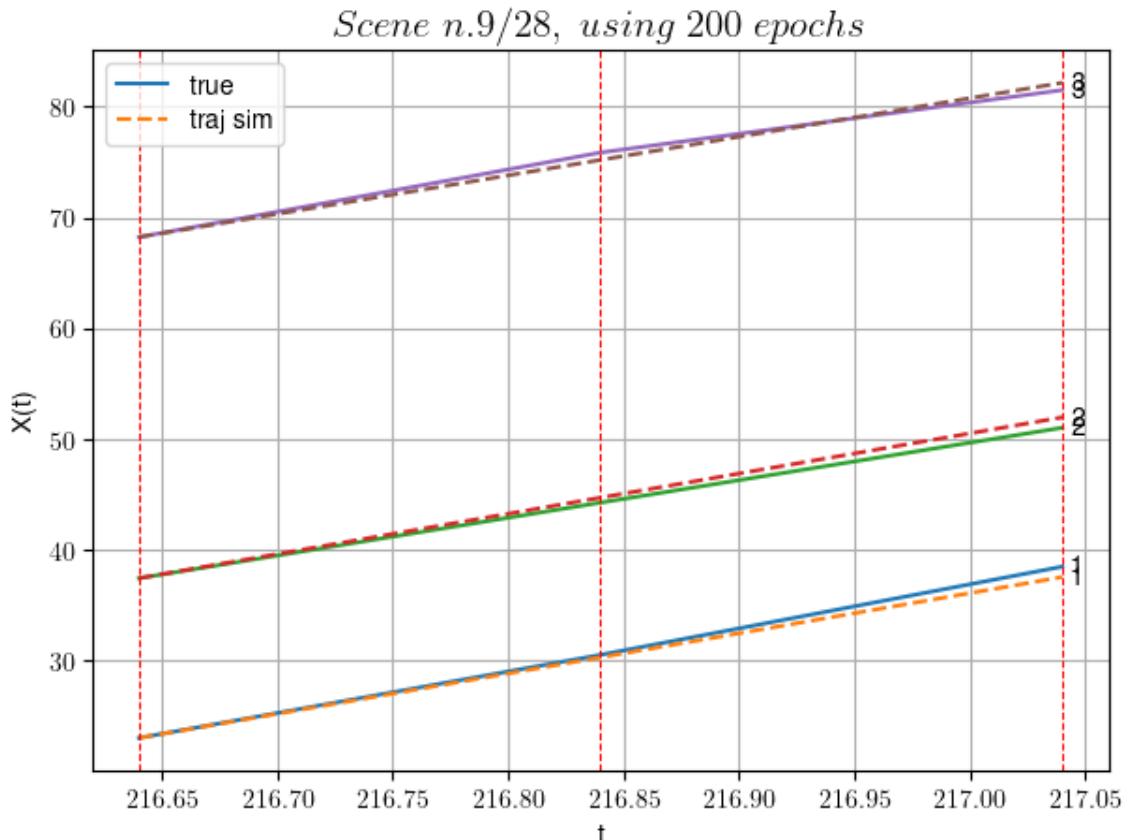
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Scene n.9/28, time interval:[216.64,217.04]

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Loss: 0.3231894646886742  
v0 updated: 34.84649774220546

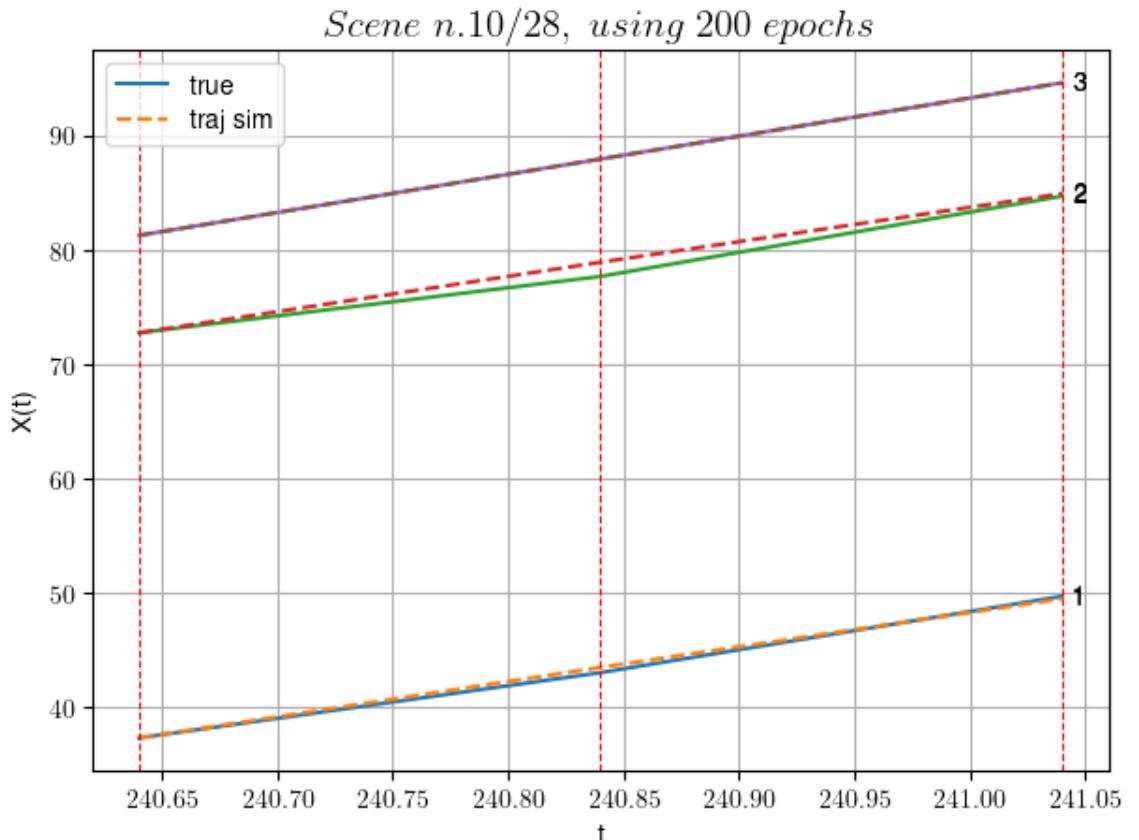
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Scene n.10/28, time interval:[240.64,241.04]

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Loss: 0.20491069866610293  
v0 updated: 33.34109723927839

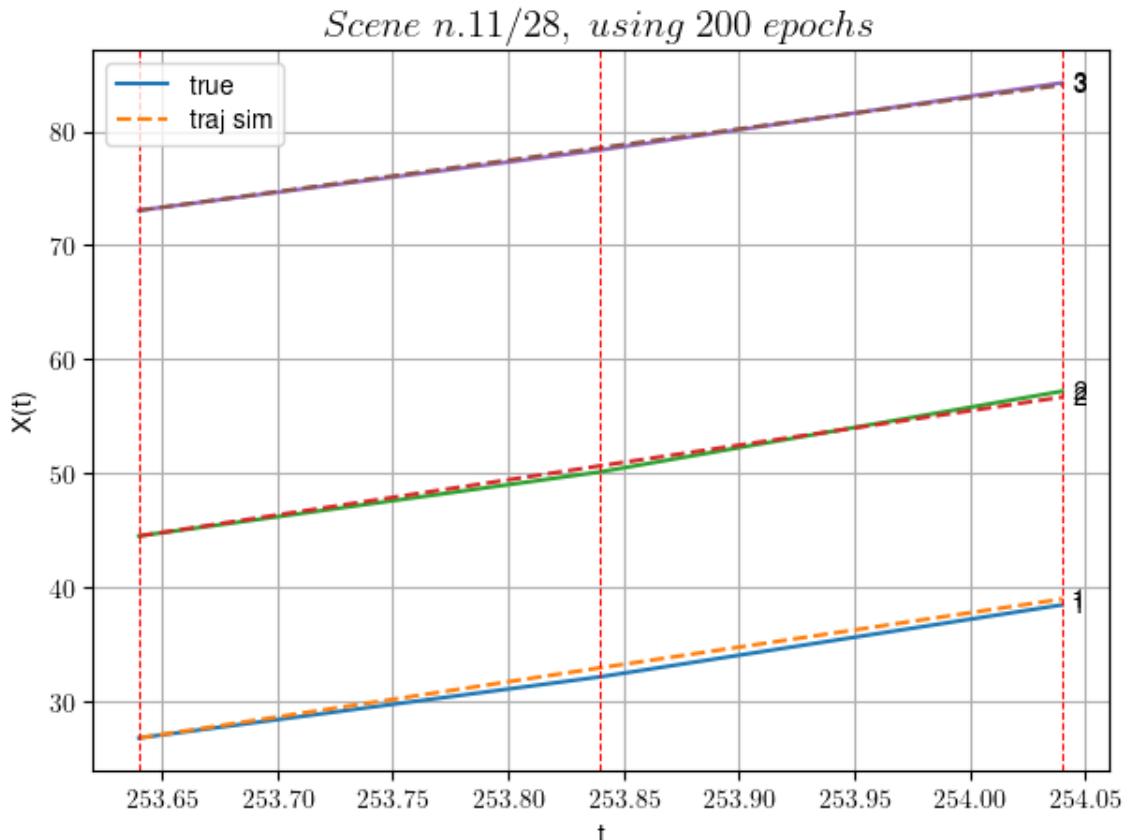
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Scene n.11/28, time interval:[253.64,254.04]

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Loss: 0.16907673672324064  
v0 updated: 27.47765219817996

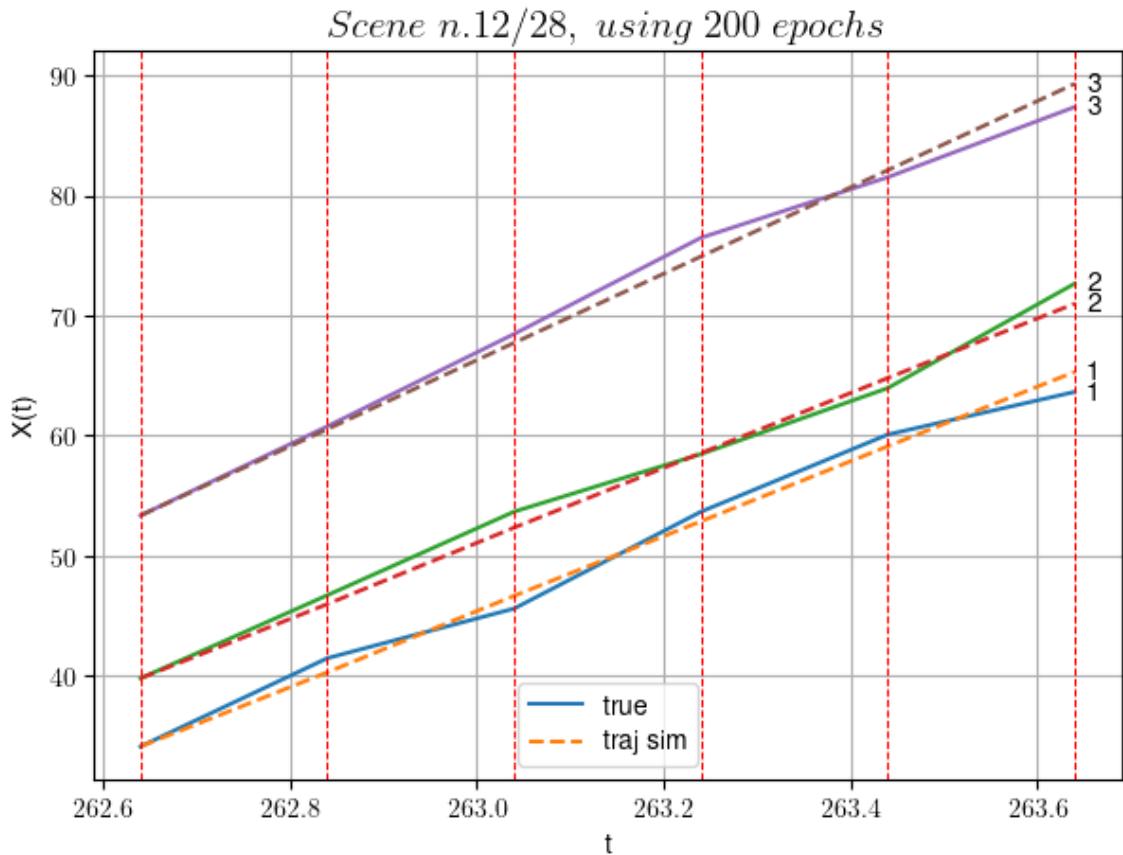
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Scene n.12/28, time interval:[262.64,263.64]

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Loss: 1.0973169648481684  
v0 updated: 35.92458500353821

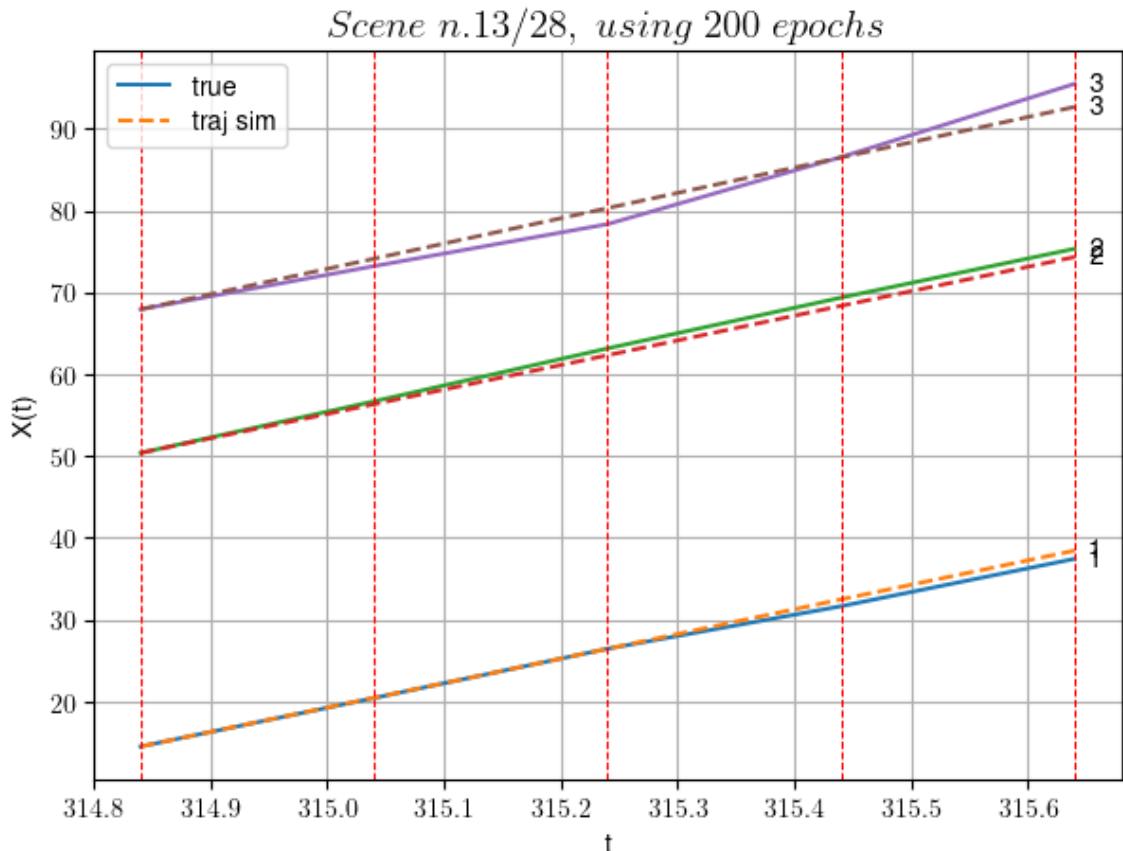
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Scene n.13/28, time interval:[314.84,315.64]

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Loss: 1.144361511143767  
v0 updated: 30.925230826449667

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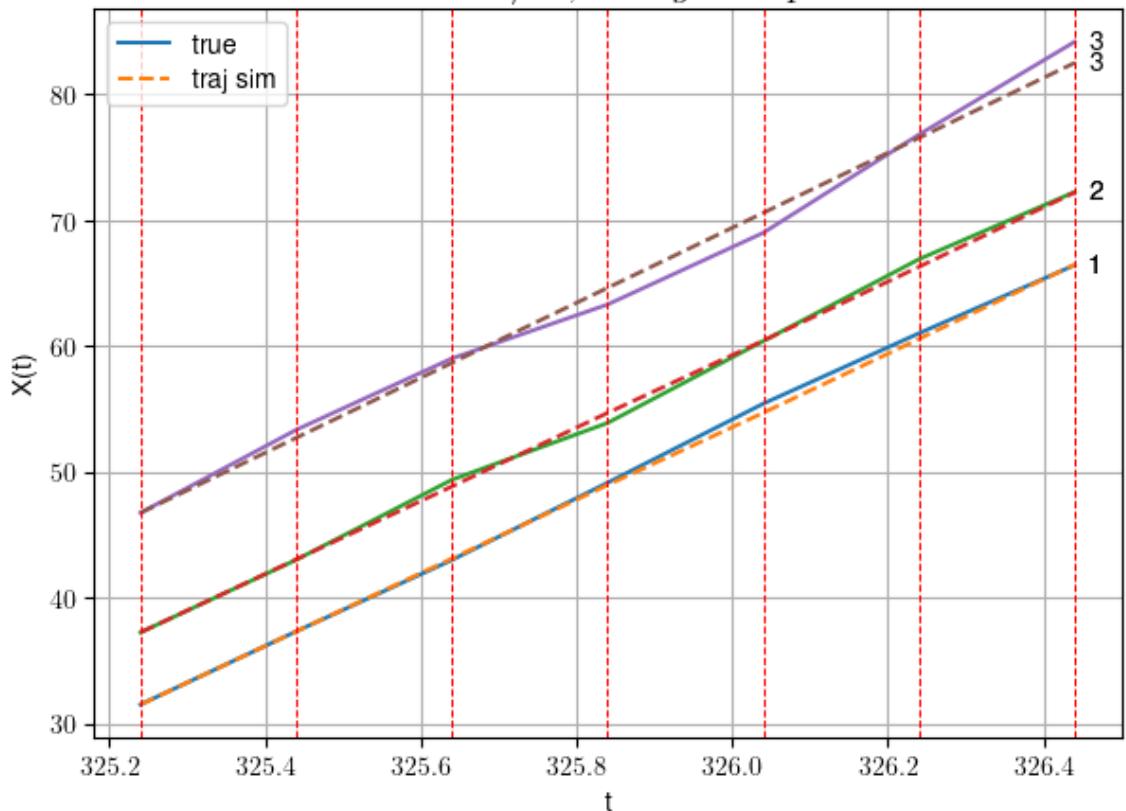
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Scene n.14/28, time interval:[325.24,326.44]

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Scene n.14/28, using 200 epochs



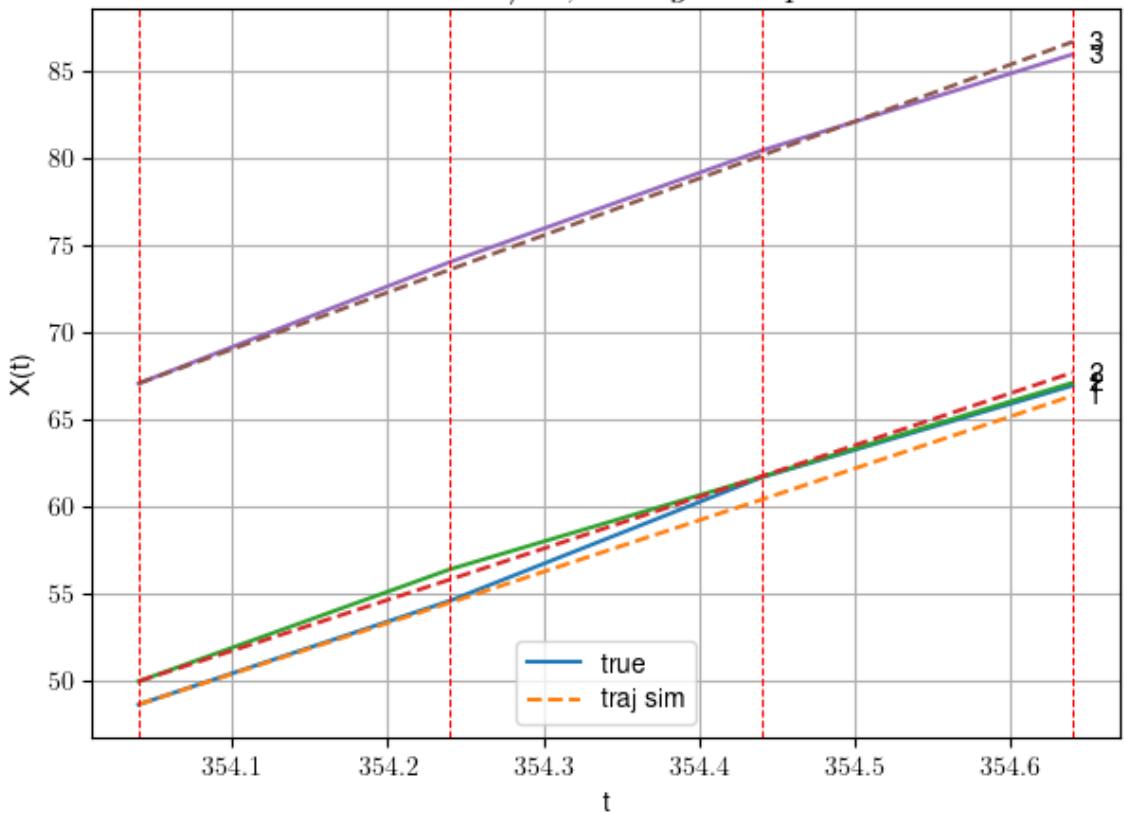
Loss: 0.46231104335713535  
v0 updated: 29.804248983551886

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Scene n.15/28, time interval:[354.04,354.64]

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Scene n.15/28, using 200 epochs

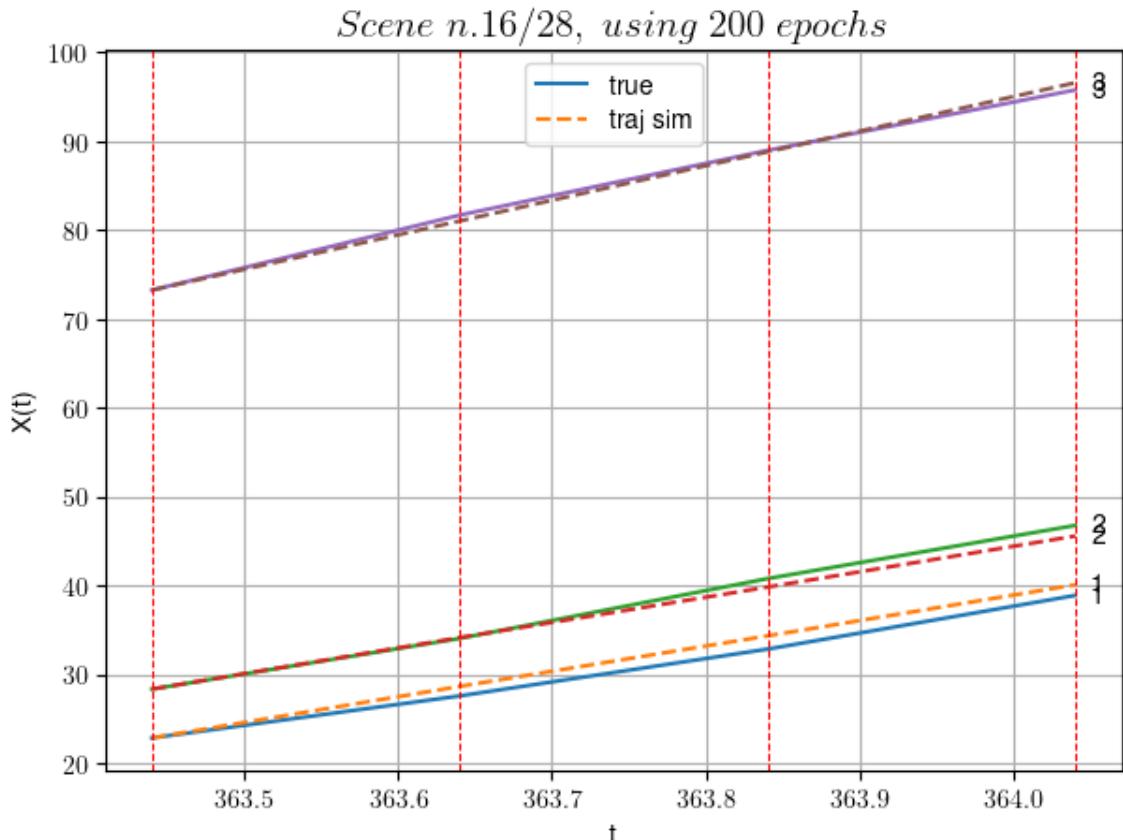


Loss: 0.2872673030184853  
v0 updated: 32.690564649739144

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Scene n.16/28, time interval:[363.44,364.04]

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Loss: 0.6882973244249807  
v0 updated: 38.91369632733983

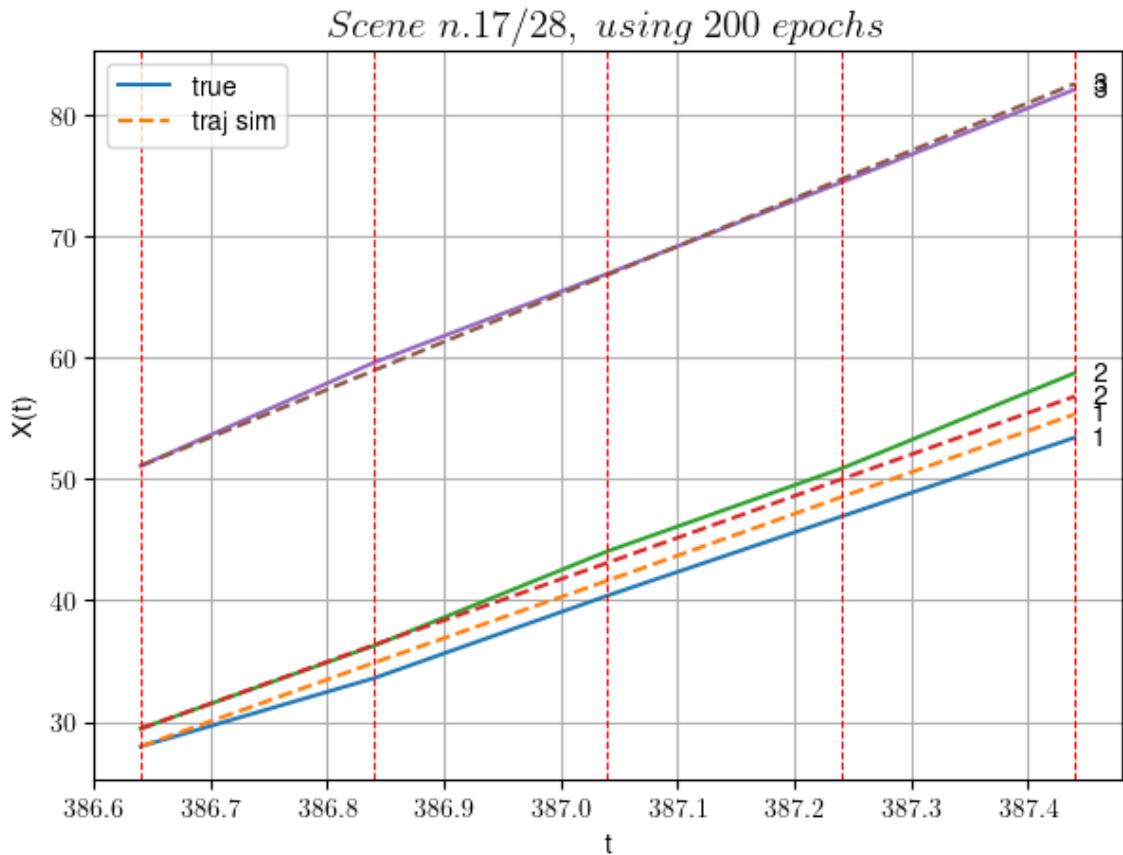
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Scene n.17/28, time interval:[386.64,387.44]

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Loss: 1.0328694510985723  
v0 updated: 39.33583802523491

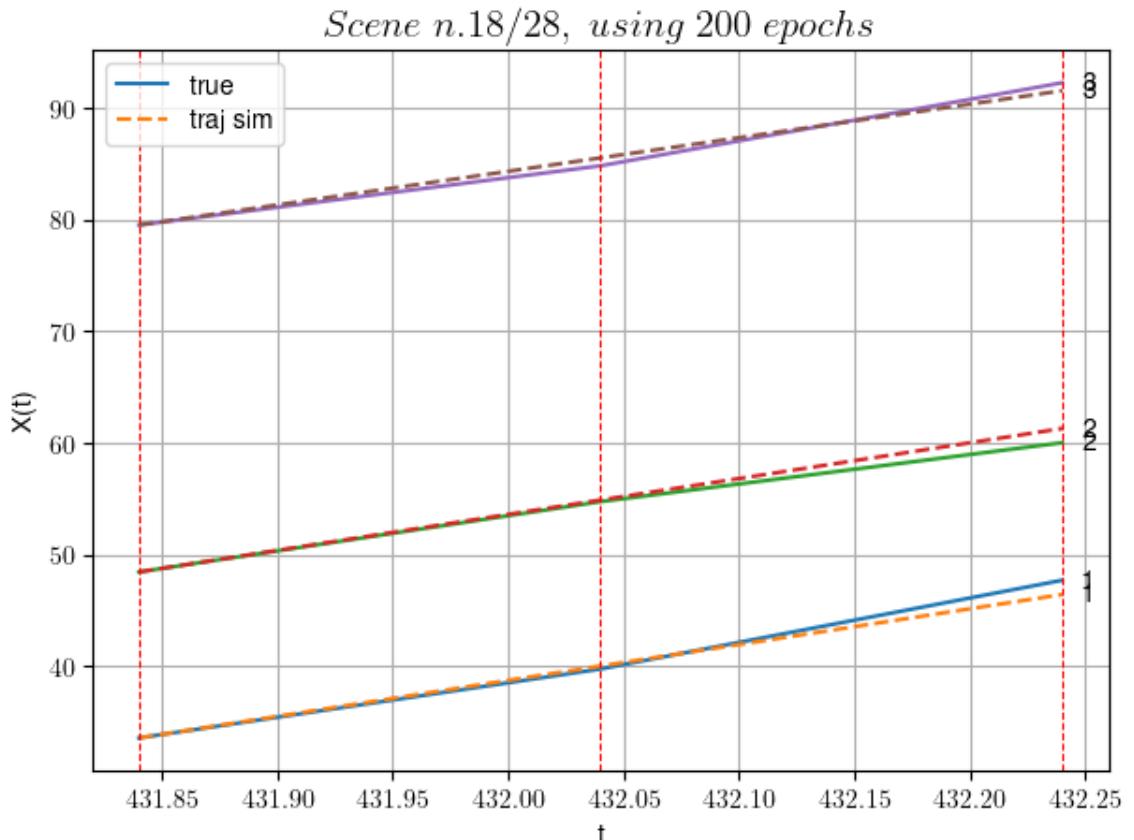
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Scene n.18/28, time interval:[431.84,432.24]

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Loss: 0.48418411872152783  
v0 updated: 30.08406922558775

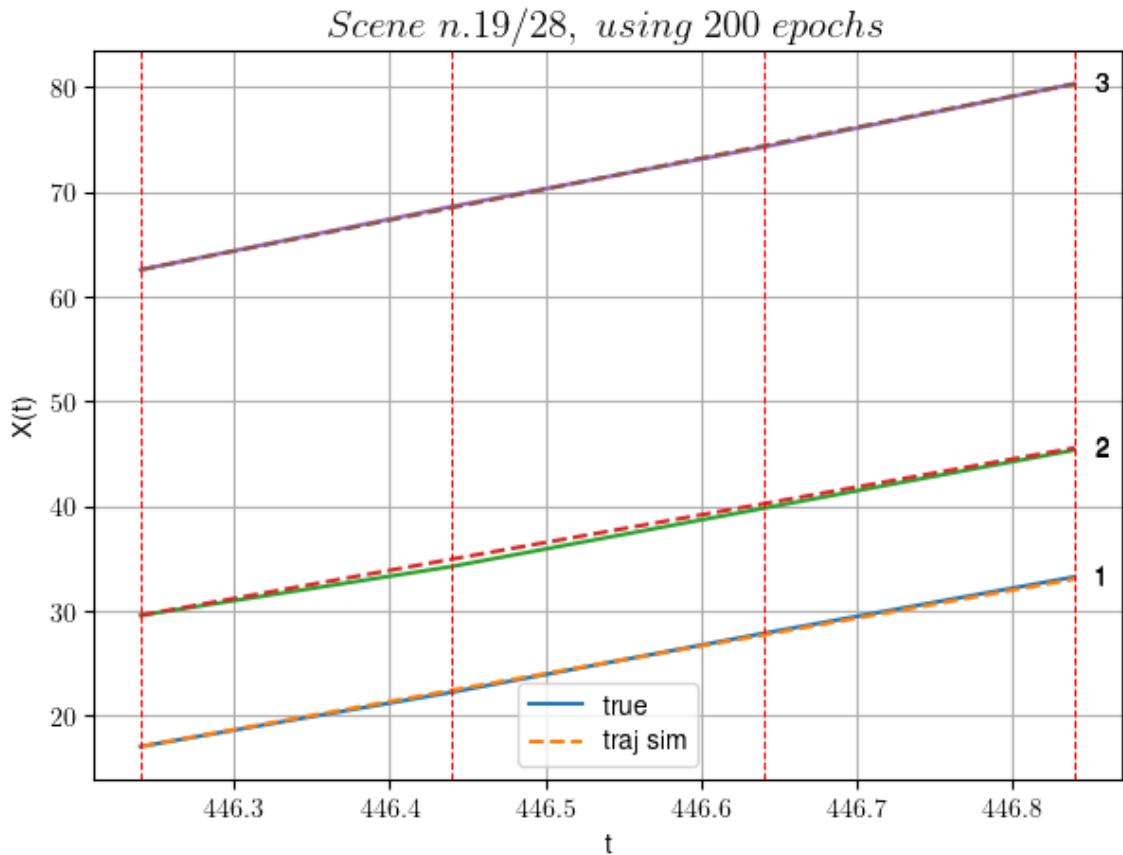
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Scene n.19/28, time interval:[446.24,446.84]

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Loss: 0.07127288365760241  
v0 updated: 29.554918451780917

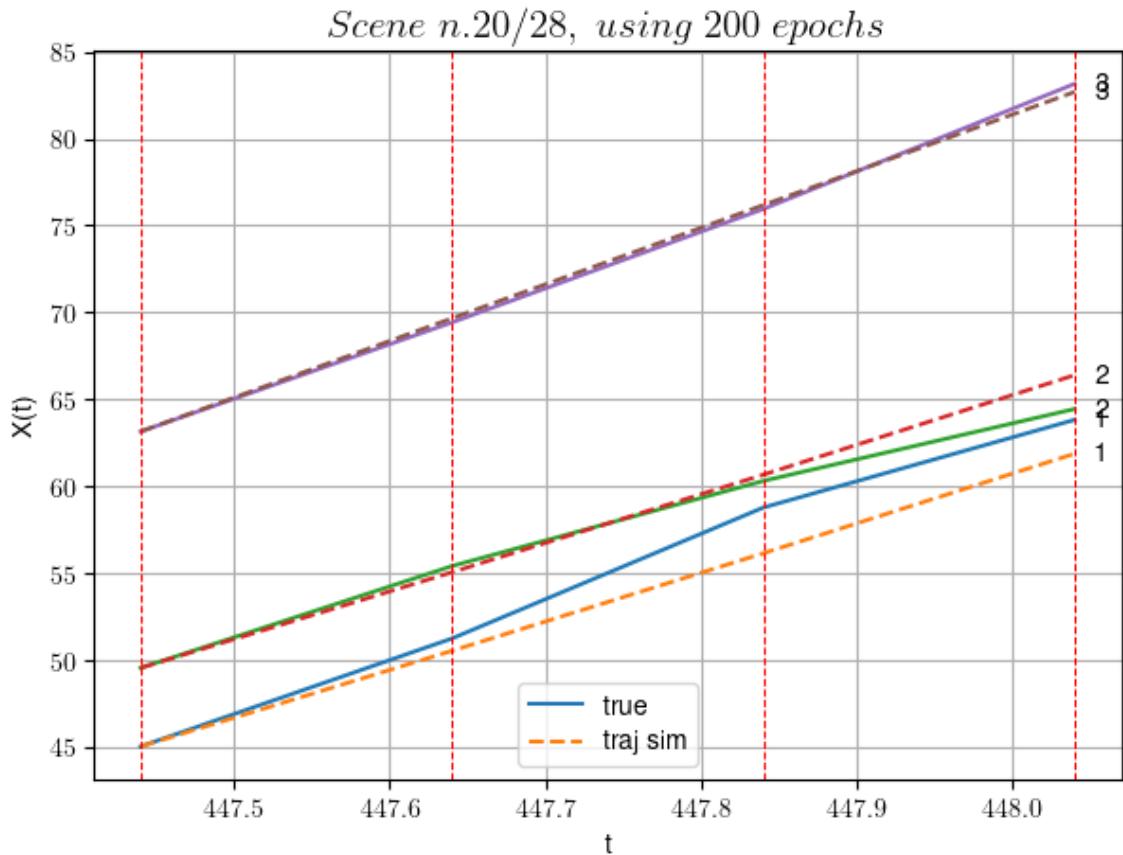
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Scene n.20/28, time interval:[447.44,448.04]

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Loss: 1.299719510871809  
v0 updated: 32.5820218344366

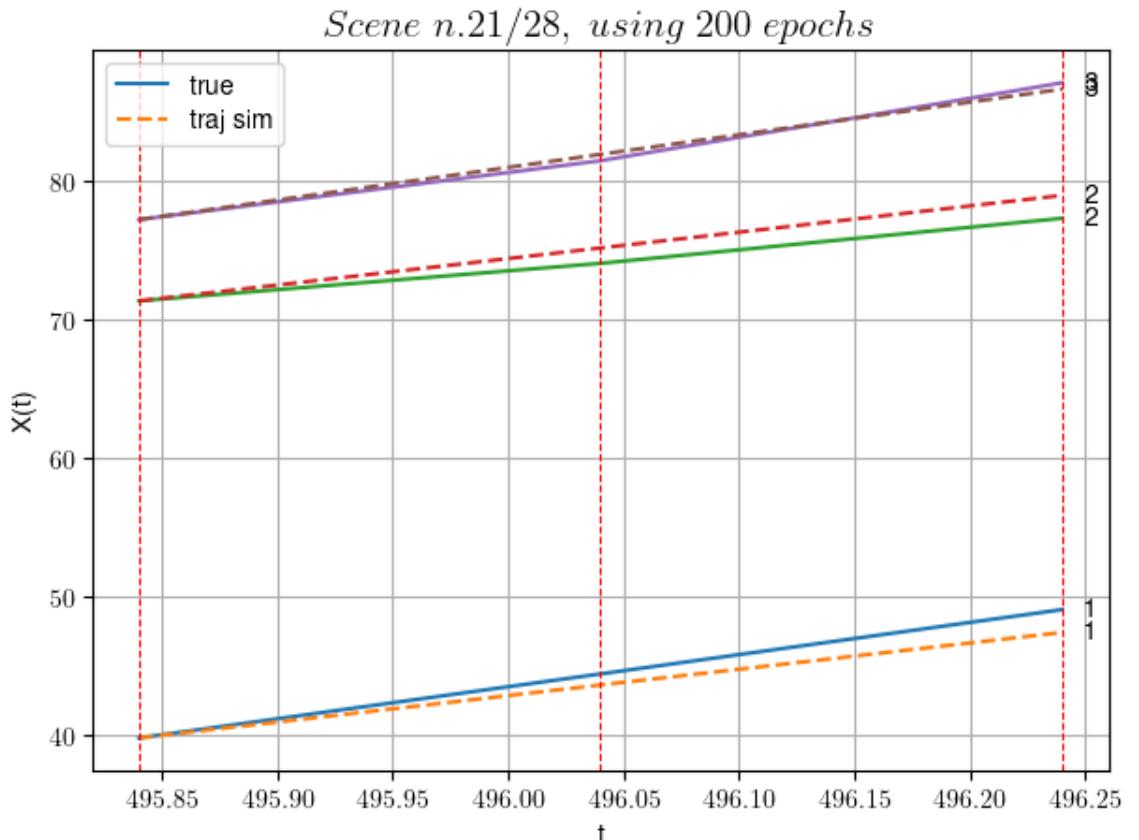
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Scene n.21/28, time interval:[495.84,496.24]

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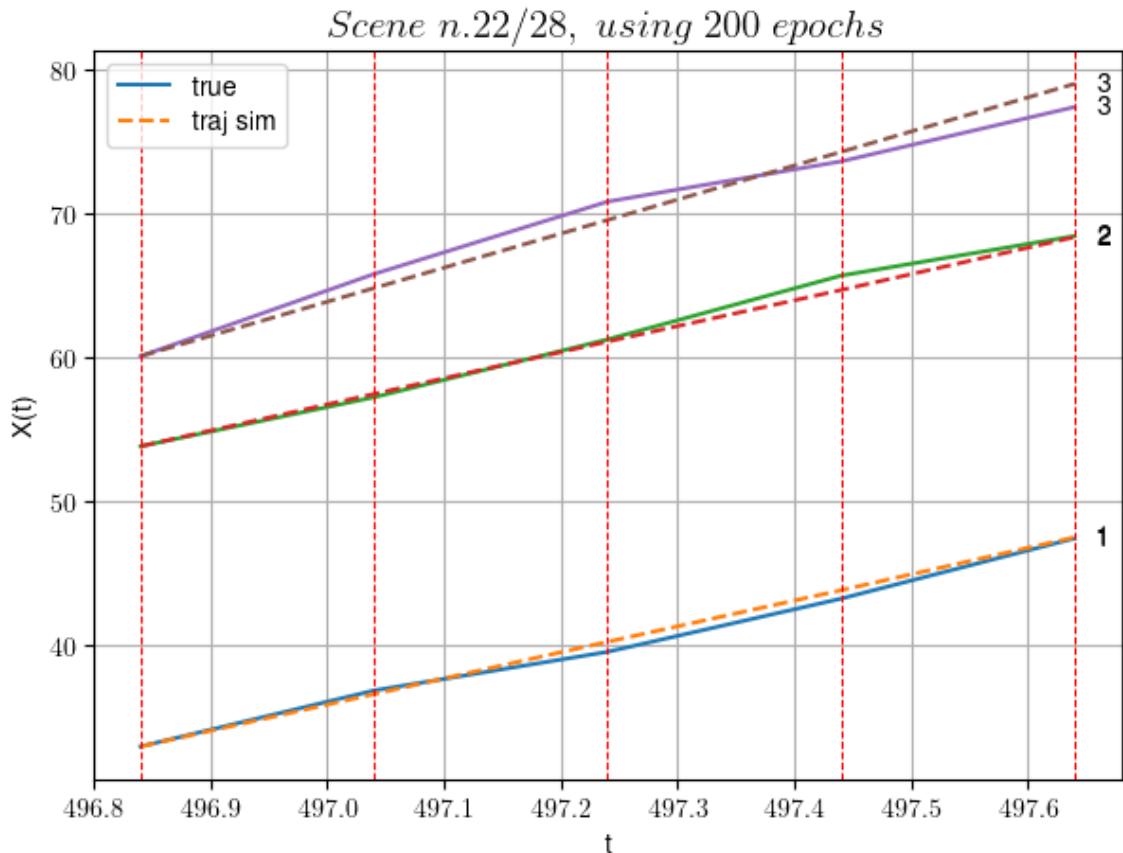


Loss: 0.8615967009990994  
v0 updated: 23.570161299904782

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Scene n.22/28, time interval:[496.84,497.64]

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Loss: 0.5072481926100189  
v0 updated: 23.67797143206563

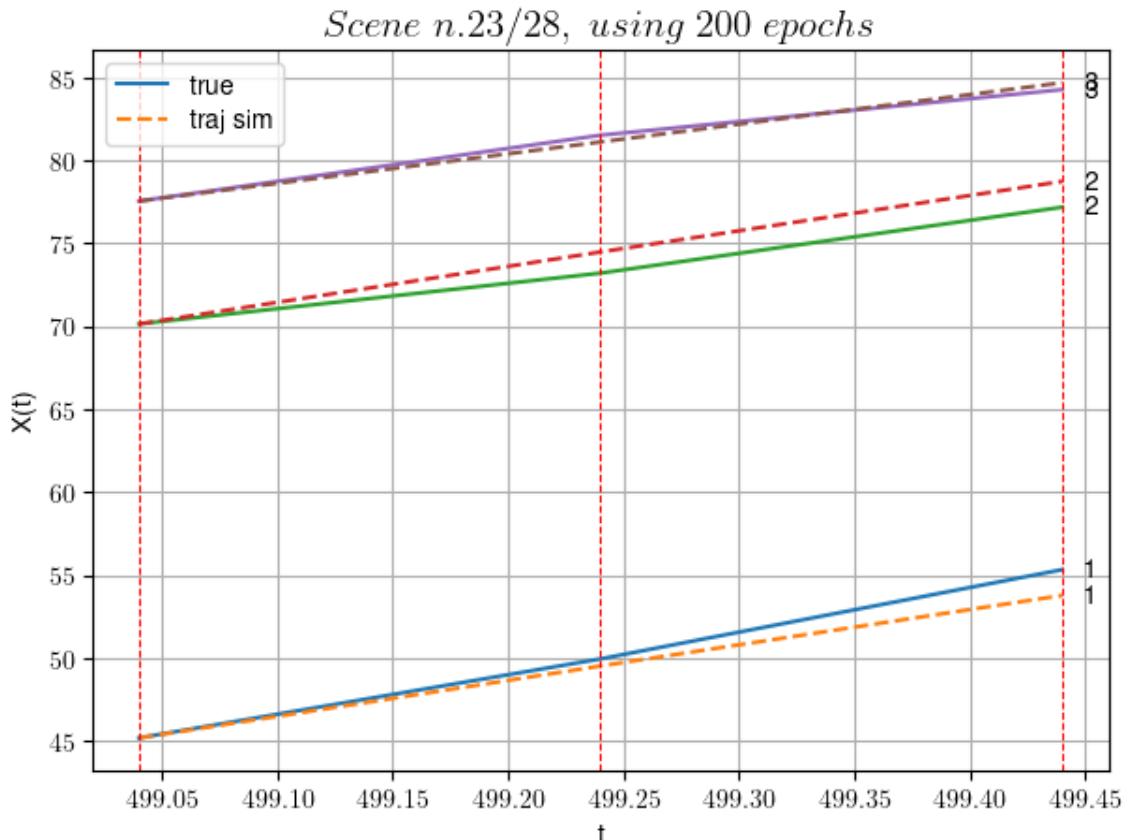
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Scene n.23/28, time interval:[499.04,499.44]

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Loss: 0.7756527367514844  
v0 updated: 17.845523963555102

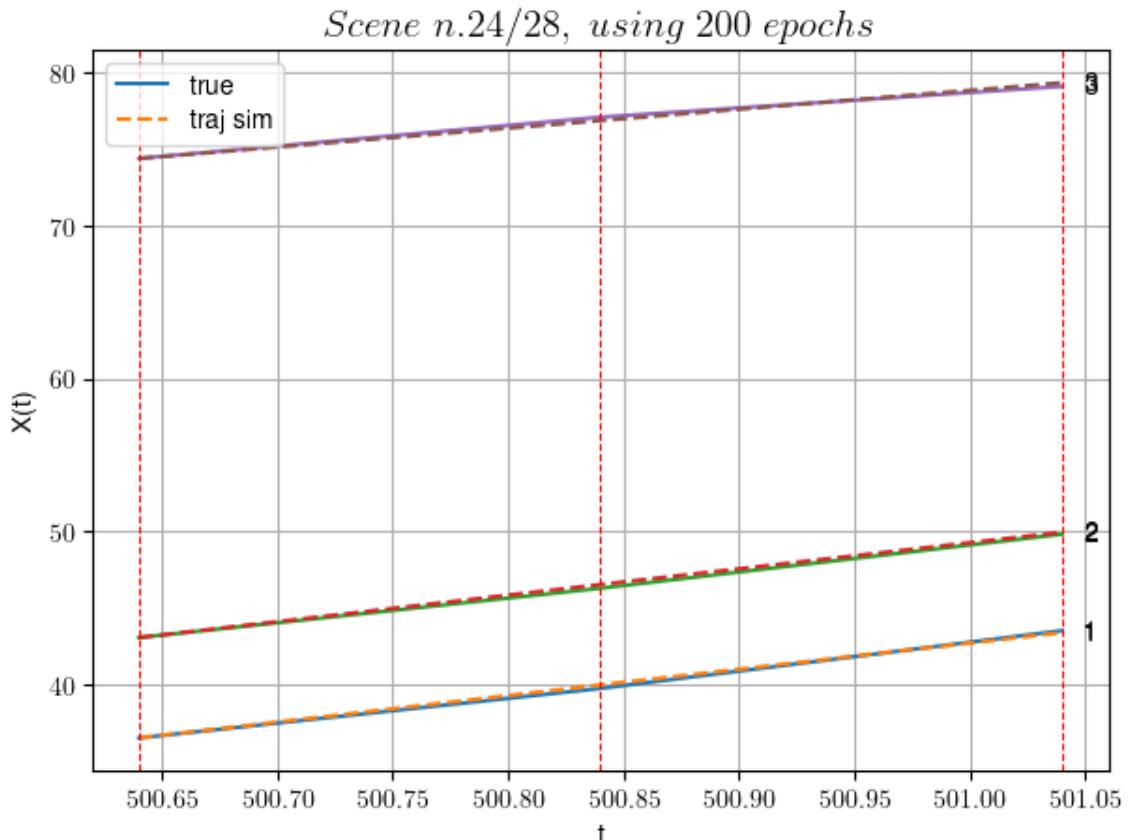
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Scene n.24/28, time interval:[500.64,501.04]

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Loss: 0.028112743979043106  
v0 updated: 12.38073766898182

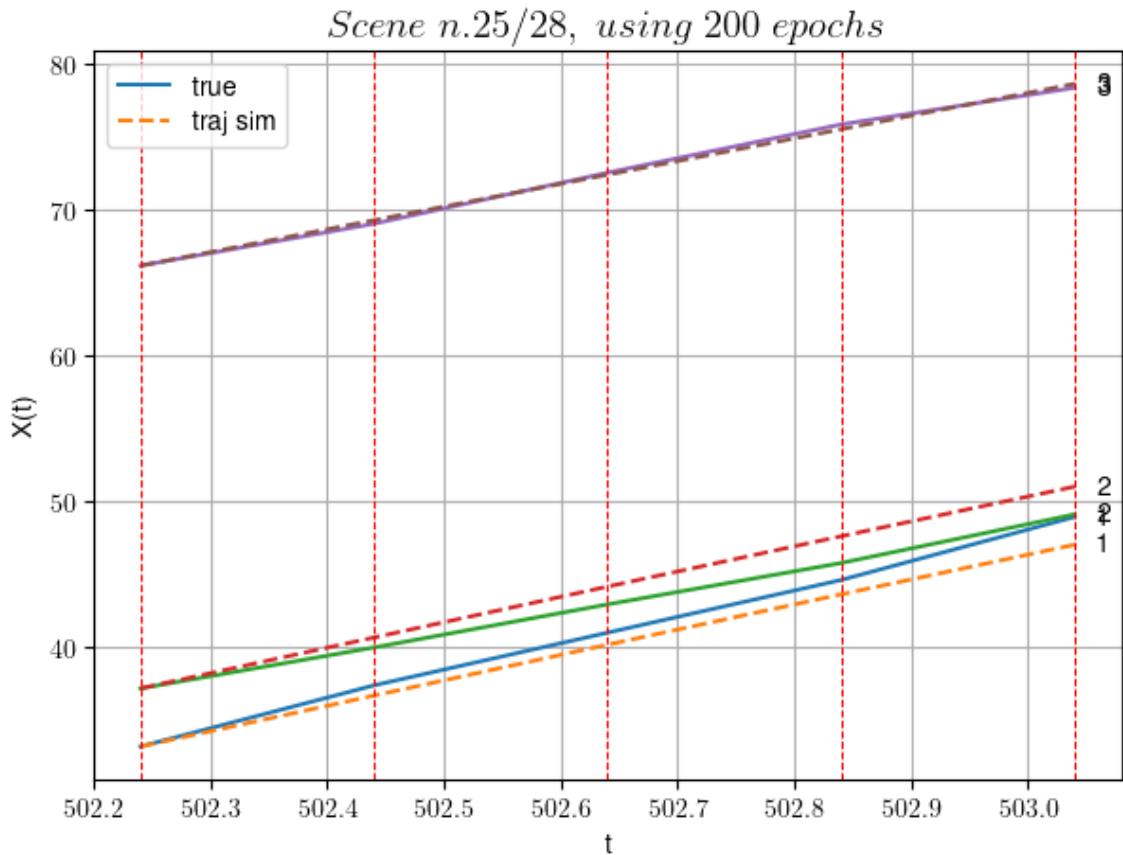
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Scene n.25/28, time interval:[502.24,503.04]

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Loss: 1.000827657226351  
v0 updated: 15.596848958505237

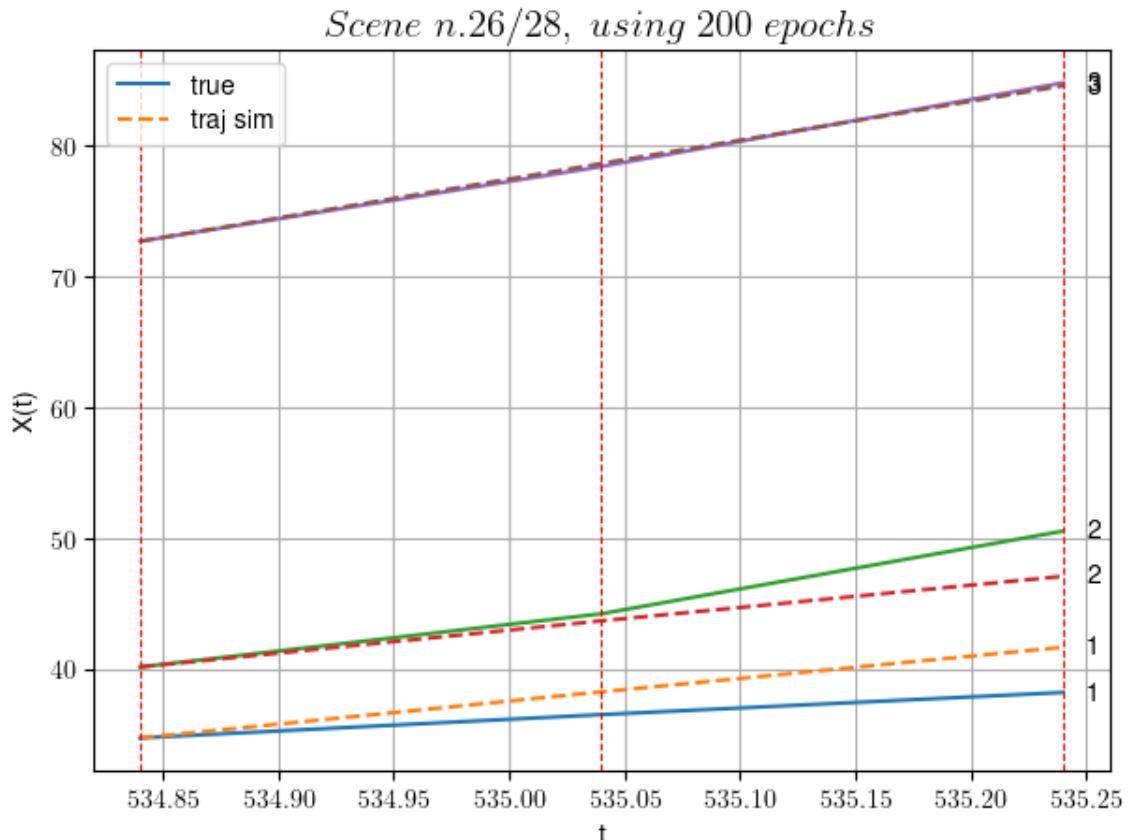
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Scene n.26/28, time interval:[534.84,535.24]

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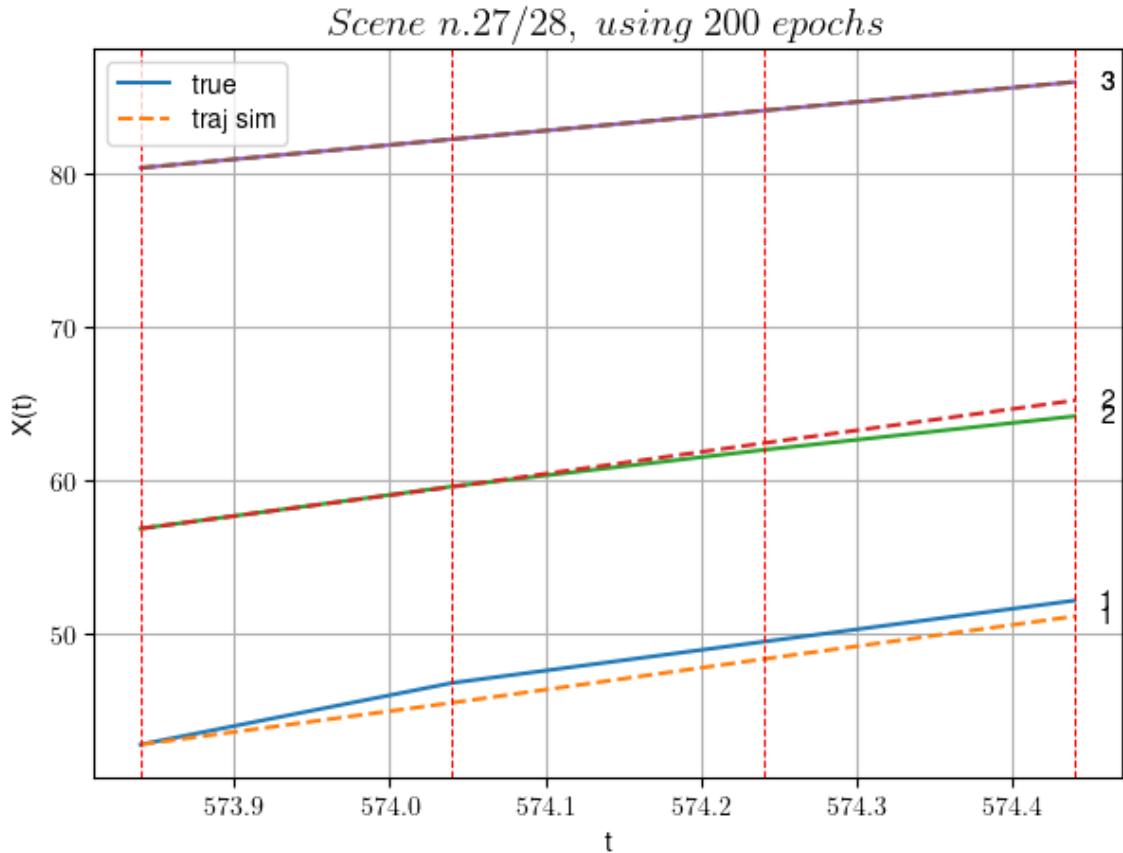


Loss: 3.0435613296624466  
v0 updated: 29.753753037486266

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Scene n.27/28, time interval:[573.84,574.44]

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v0\_mean in this df is: 28.93269326554169  
Time taken: 144.28s  
Hidden-Layer-1/kernel:0: [-1543128.6 -2946.929]  
Hidden-Layer-1/bias:0: [-76481.914 -237.7462]  
Output-Layer/kernel:0: [-1.2088498e+06 -3.2554160e+02]  
Output-Layer/bias:0: [13.606243]

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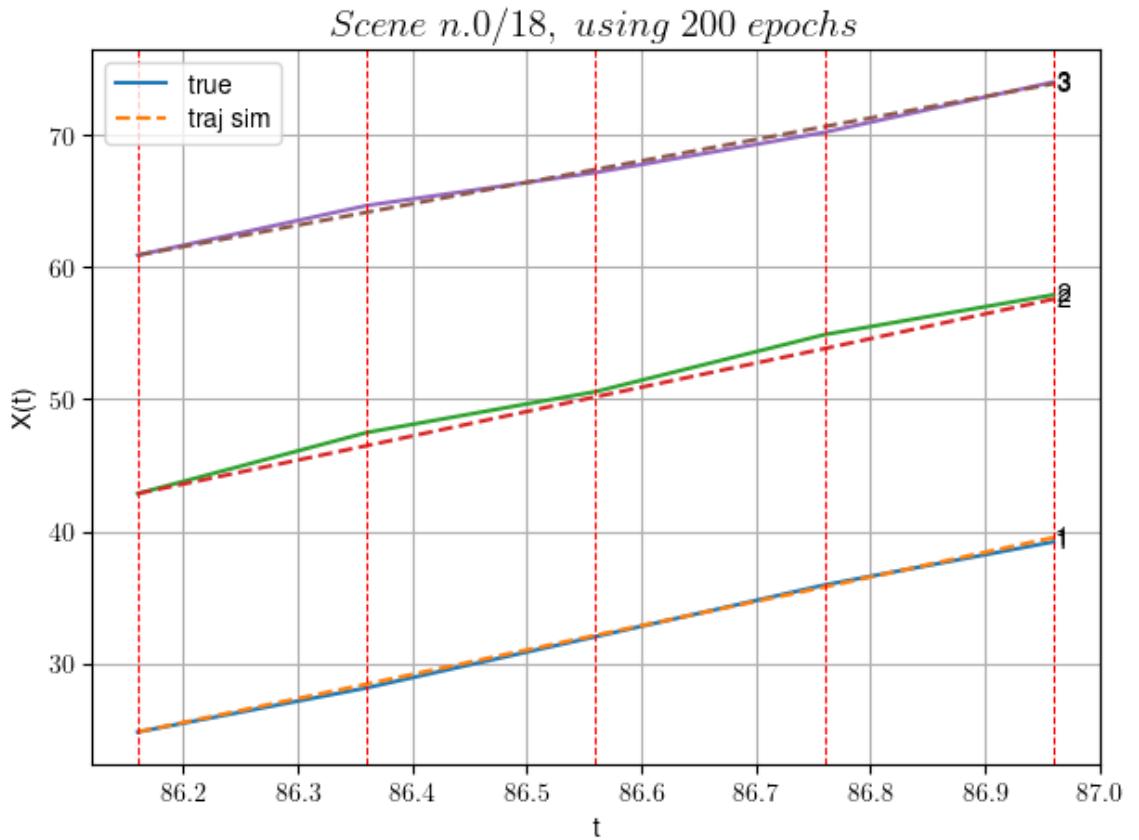
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In df n.2/10 we have 18 scenes

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Scene n.0/18, time interval:[86.16,86.96]

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Loss: 0.20828001171308383  
v0 updated: 16.25044385096199

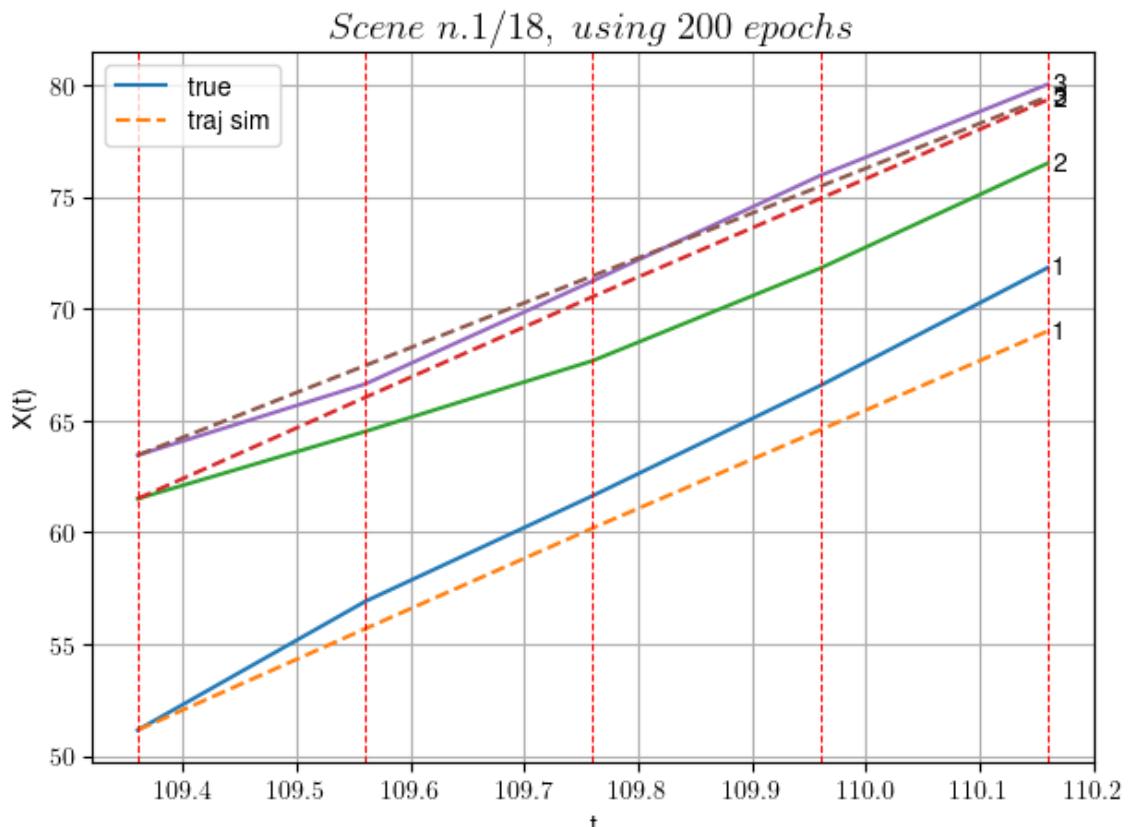
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Scene n.1/18, time interval:[109.36,110.16]

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Loss: 3.0105596170105646  
v0 updated: 20.044801660133817

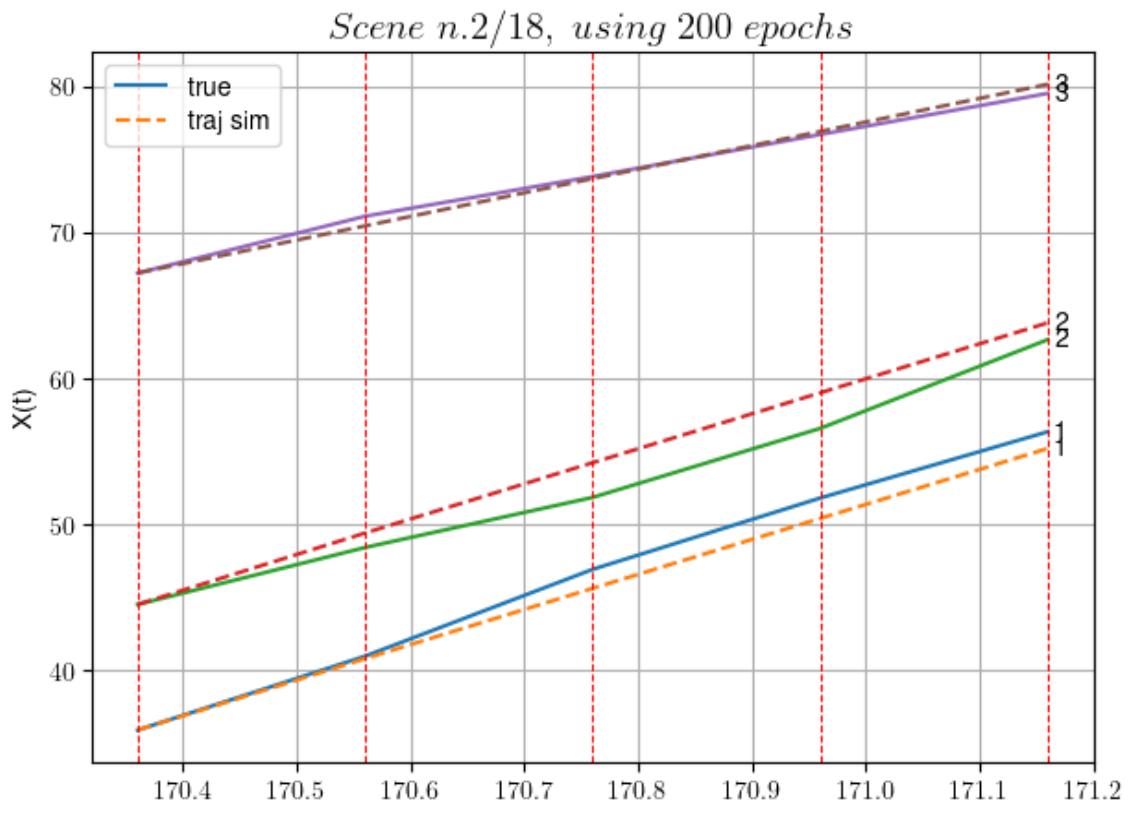
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Scene n.2/18, time interval:[170.36,171.16]

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Loss: 1.3181672877937032  
v0 updated: 16.166815108702973

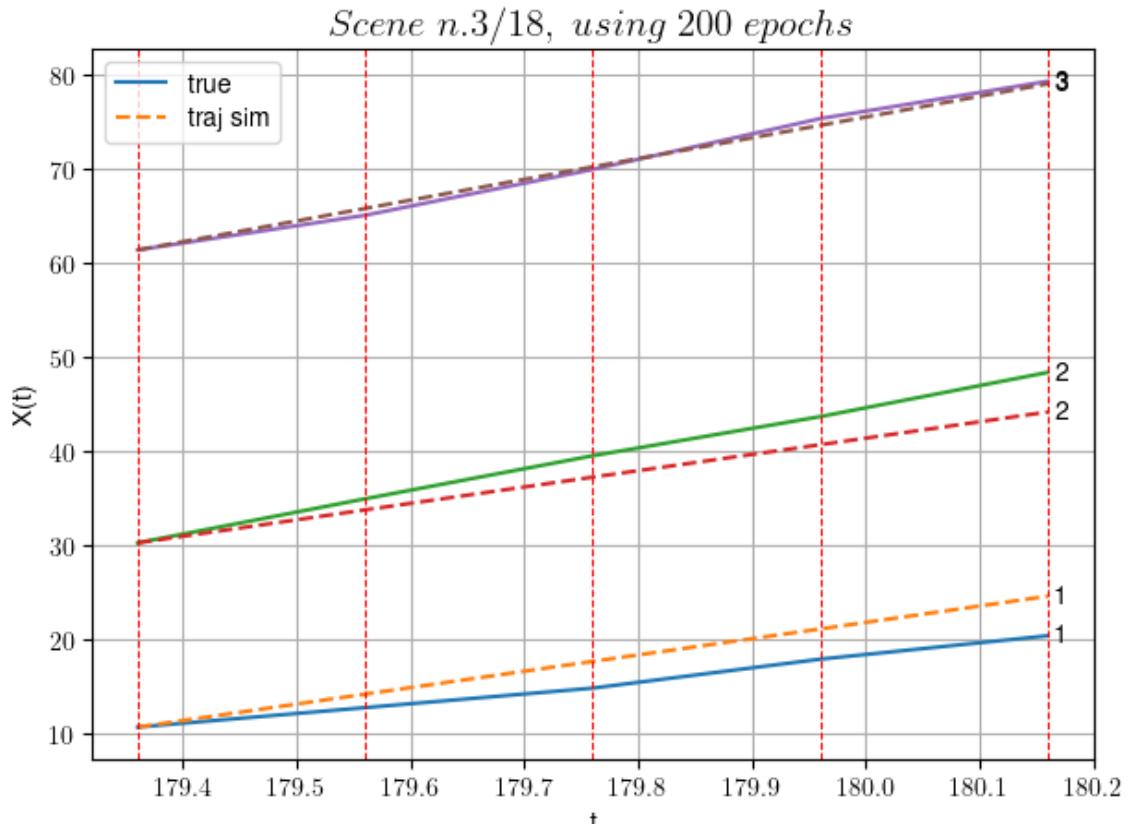
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Scene n.3/18, time interval:[179.36,180.16]

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Loss: 4.83559825068946  
v0 updated: 22.09069359979243

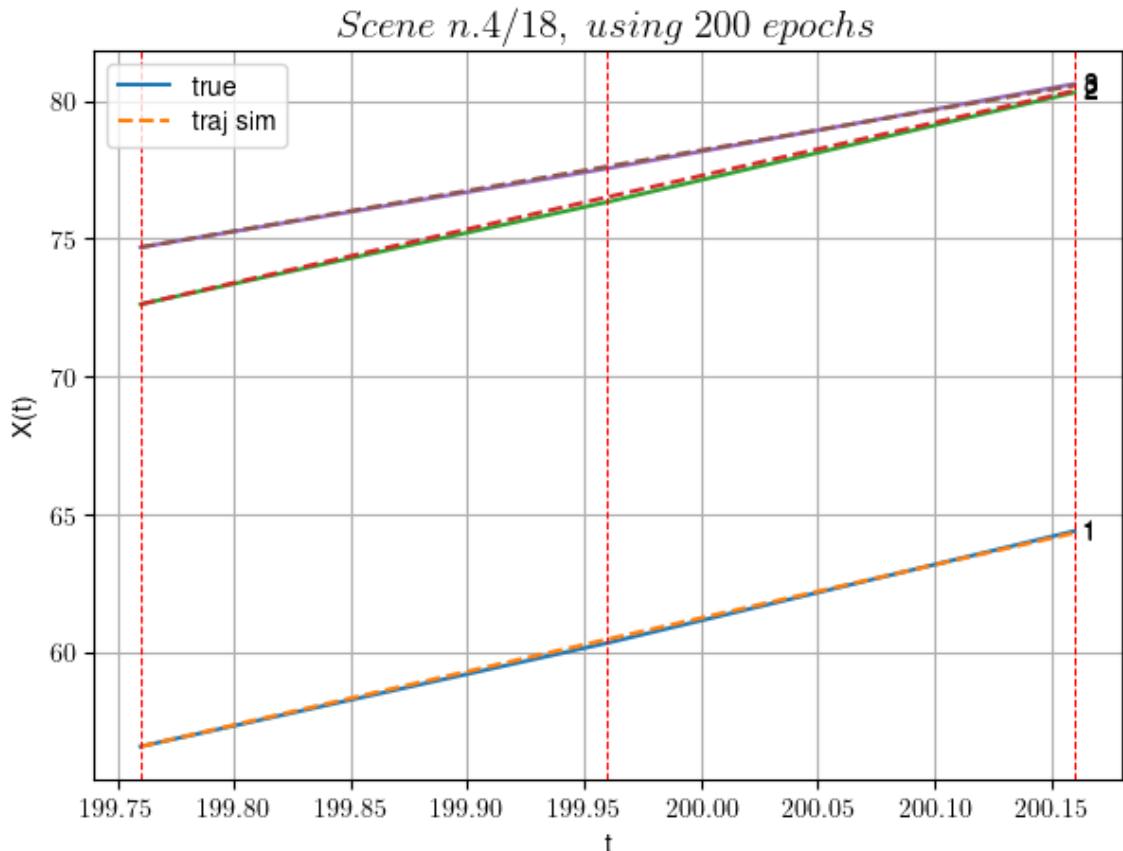
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Scene n.4/18, time interval:[199.76,200.16]

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Loss: 0.007640975306292695  
v $\theta$  updated: 14.66852263472198

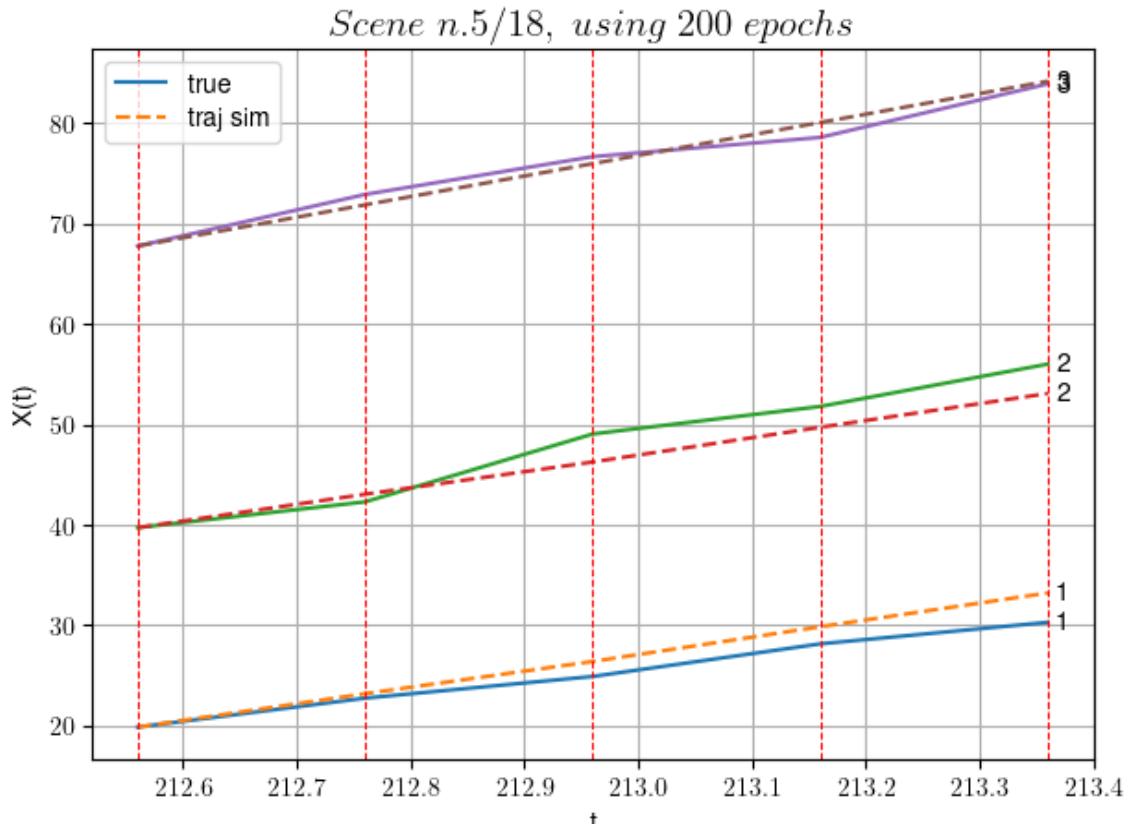
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Scene n.5/18, time interval:[212.56,213.36]

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Loss: 2.5984316938181666  
v0 updated: 20.517558612694323

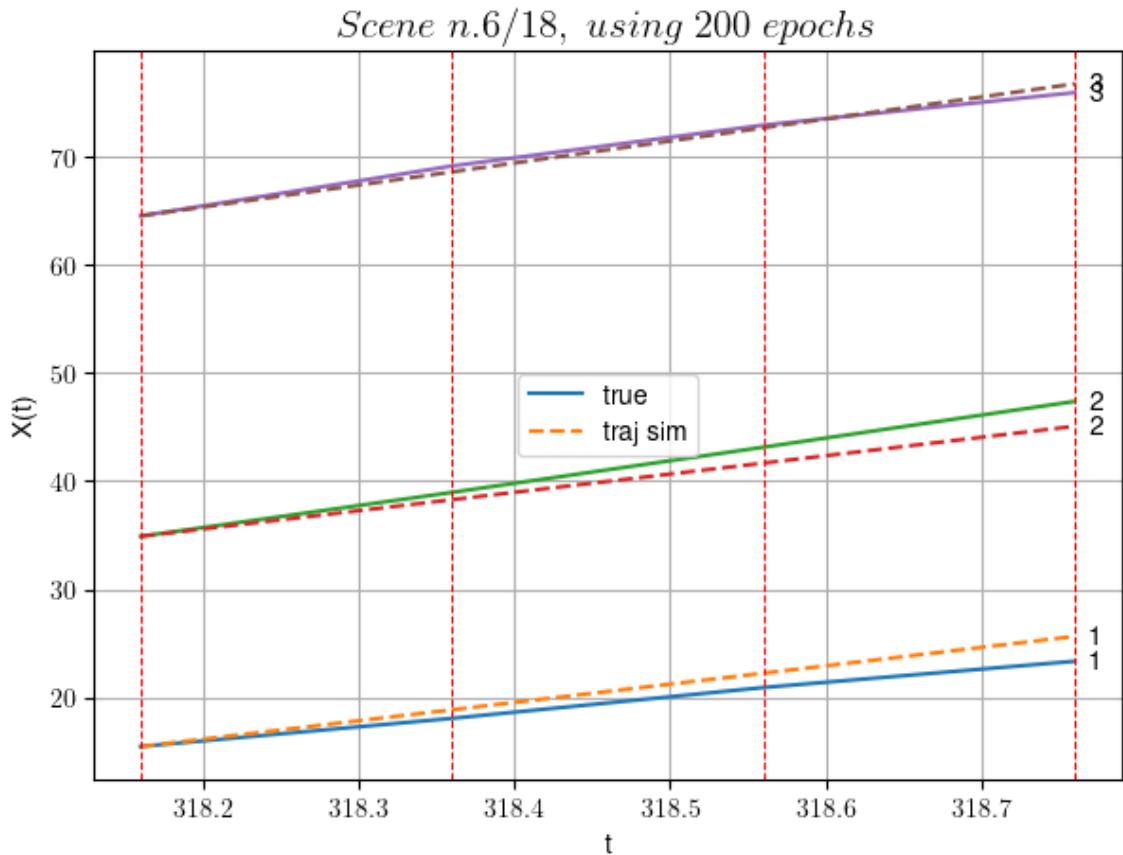
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Scene n.6/18, time interval:[318.16,318.76]

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Loss: 1.3841498736367717  
v0 updated: 20.365787750550588

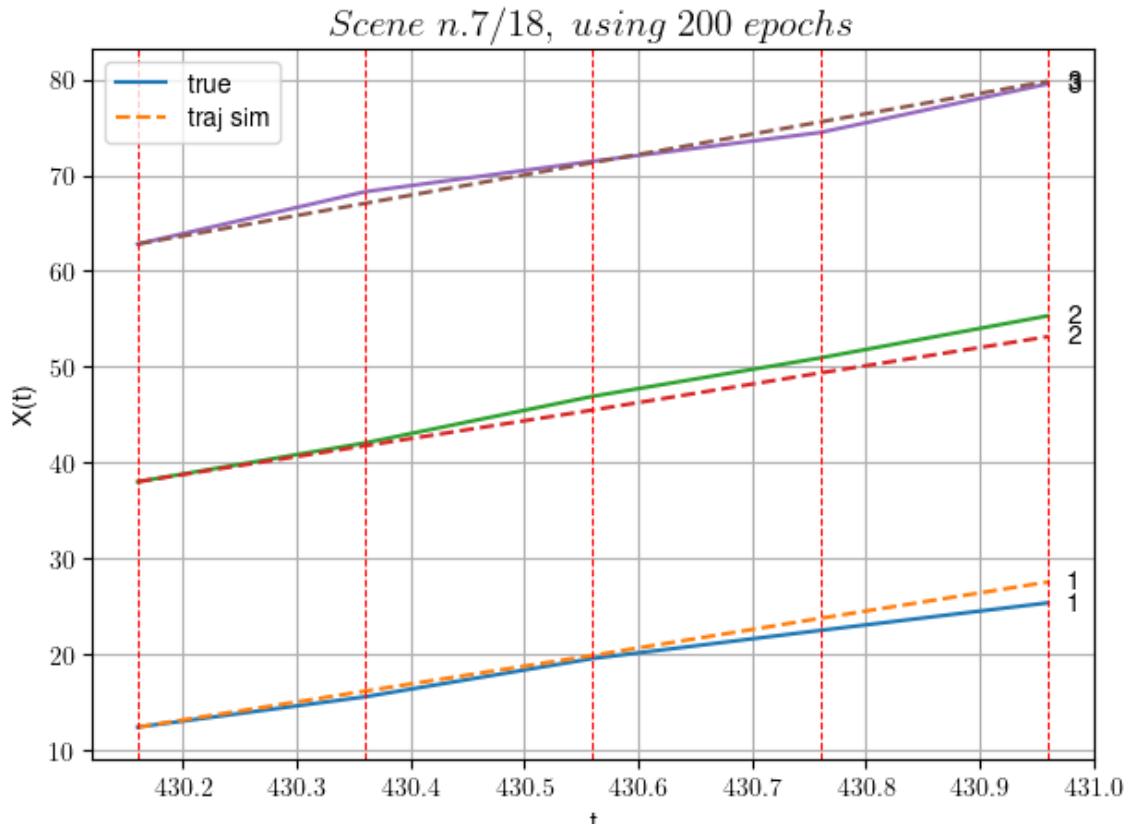
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Scene n.7/18, time interval:[430.16,430.96]

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Loss: 1.2595752219635155  
v0 updated: 21.24652473815916

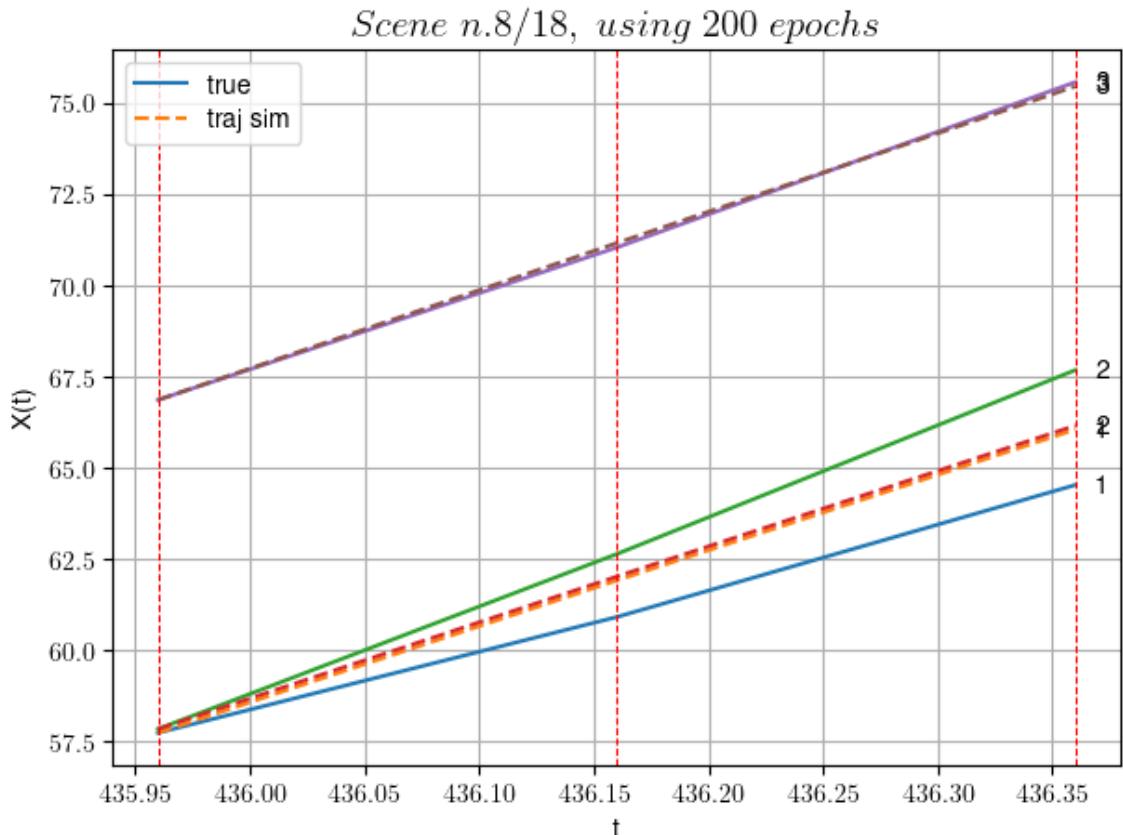
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Scene n.8/18, time interval:[435.96, 436.36]

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Loss: 0.6713854319396332  
v0 updated: 21.468093936589693

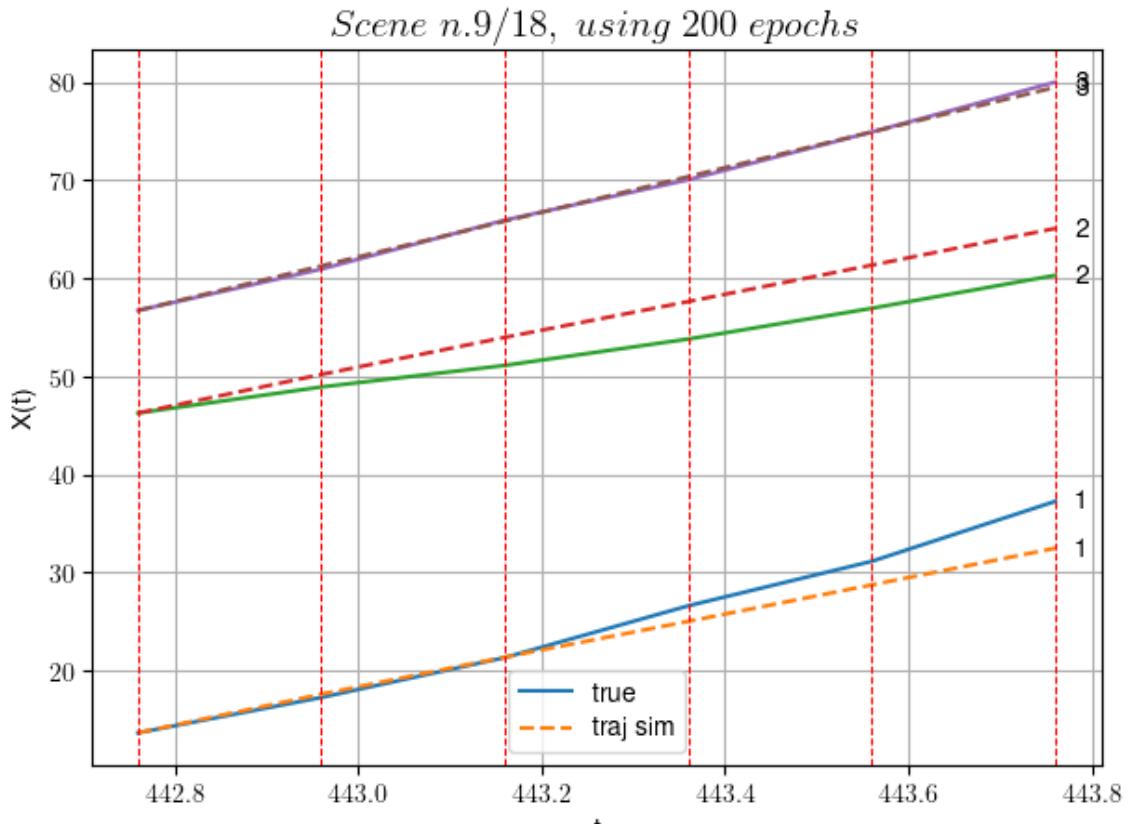
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Scene n.9/18, time interval:[442.76,443.76]

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Loss: 5.474290616104508  
v0 updated: 22.78382896397465

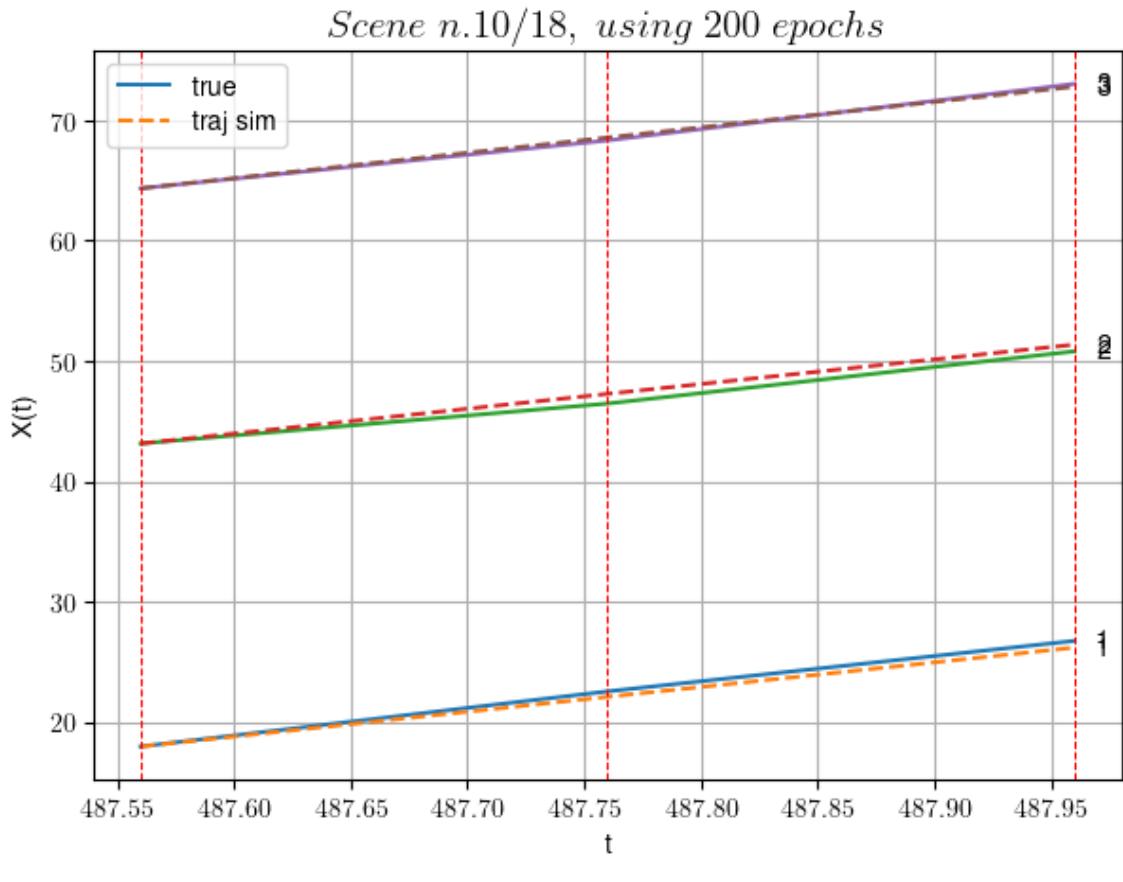
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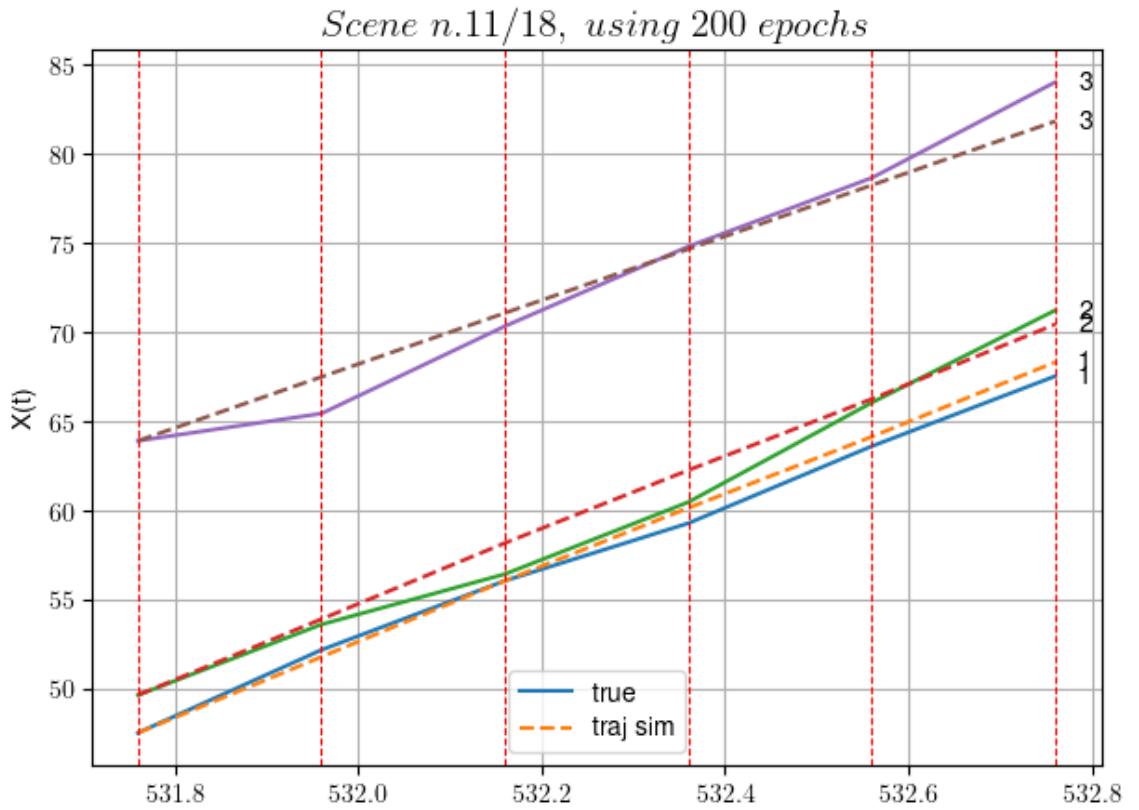
Scene n.10/18, time interval:[487.56,487.96]

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Scene n.11/18, time interval:[531.76,532.76]



Loss: 1.0324429113631268  
v0 updated: 17.925004407992073

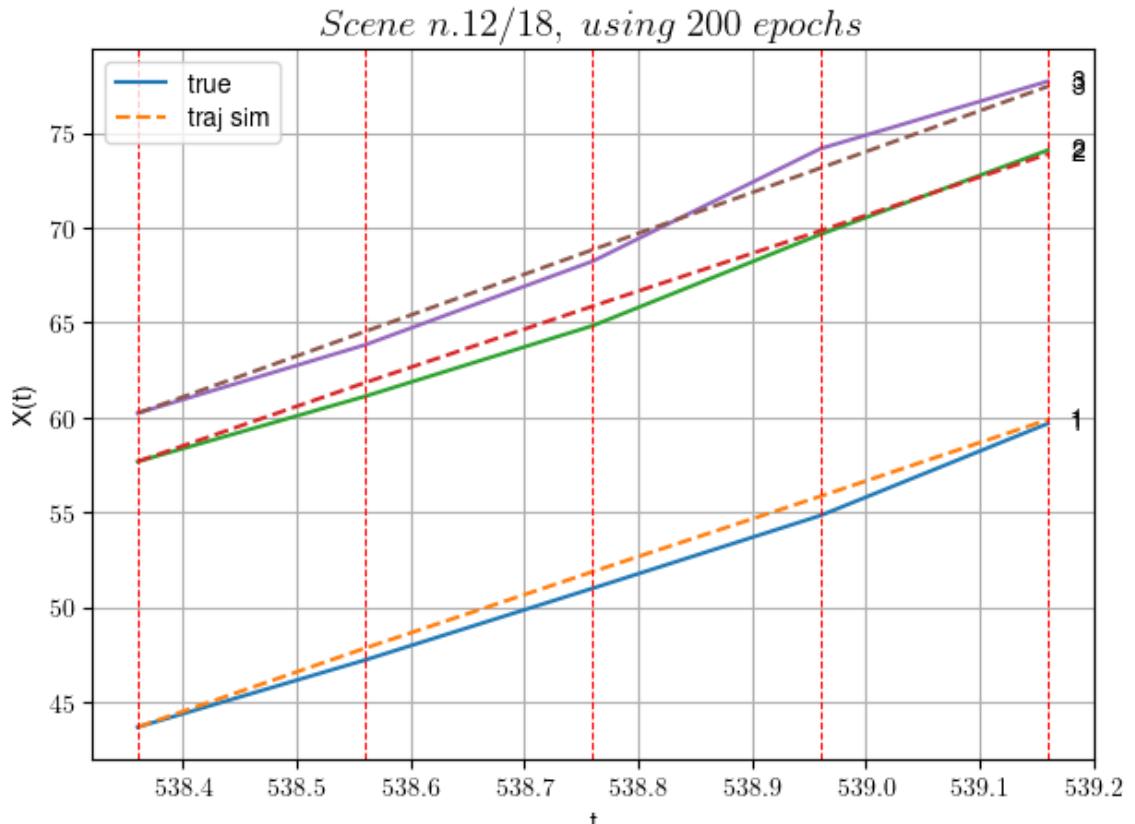
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Scene n.12/18, time interval:[538.36,539.16]

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Loss: 0.39122765425387085  
v0 updated: 21.528181738872128

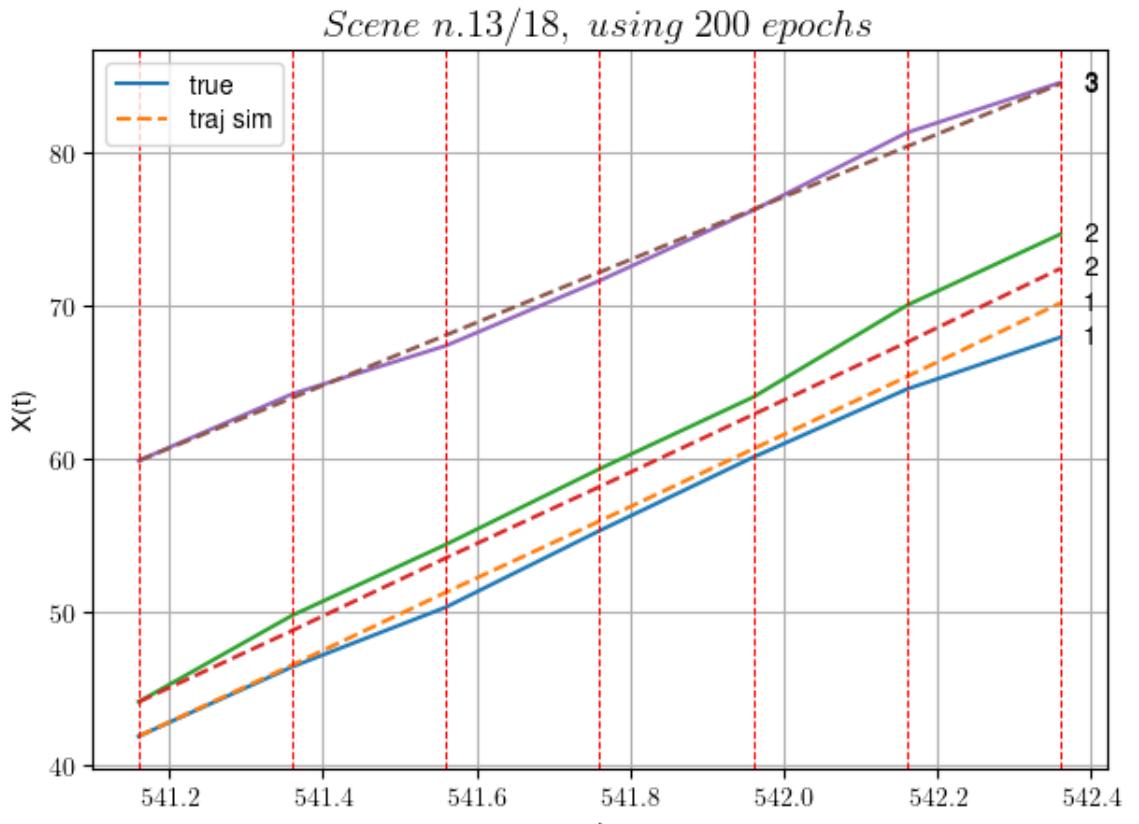
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Scene n.13/18, time interval:[541.16,542.36]

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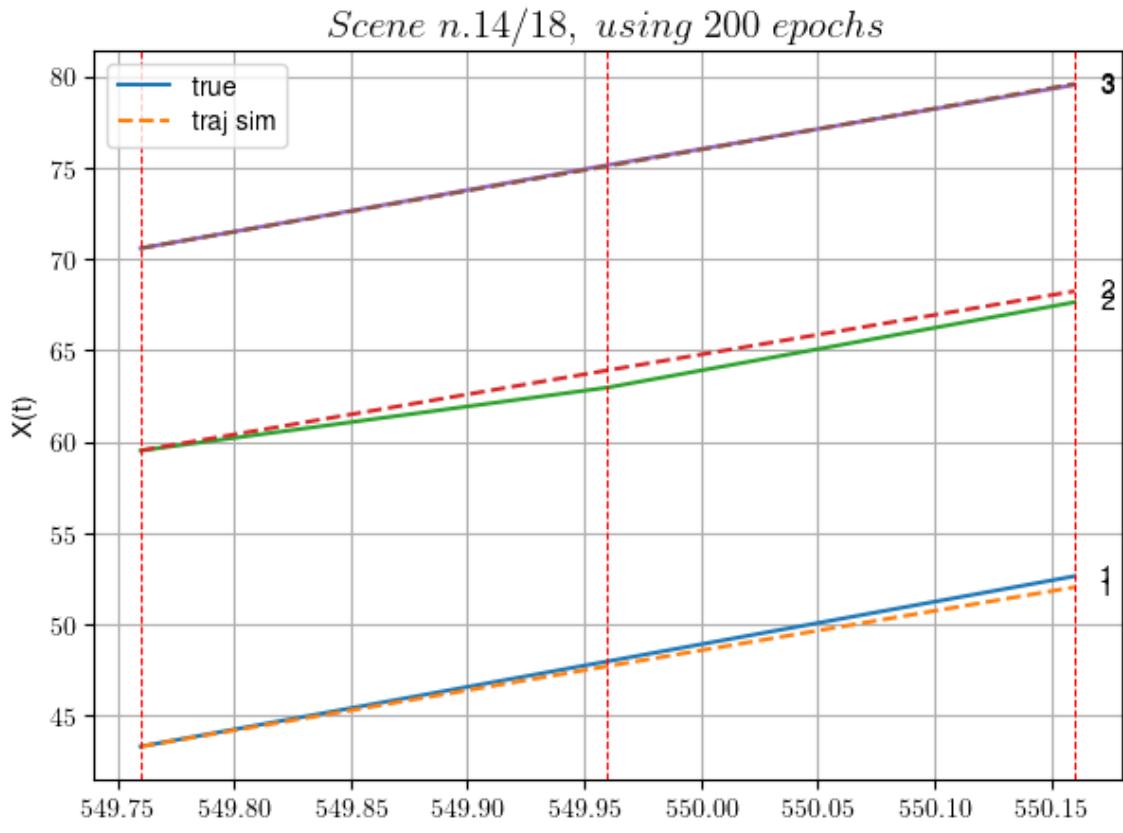


Loss: 1.1571416020930503  
v0 updated: 20.50043309196578

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Scene n.14/18, time interval:[549.76,550.16]

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Loss: 0.1875802248880658  
v0 updated: 22.503959325258233

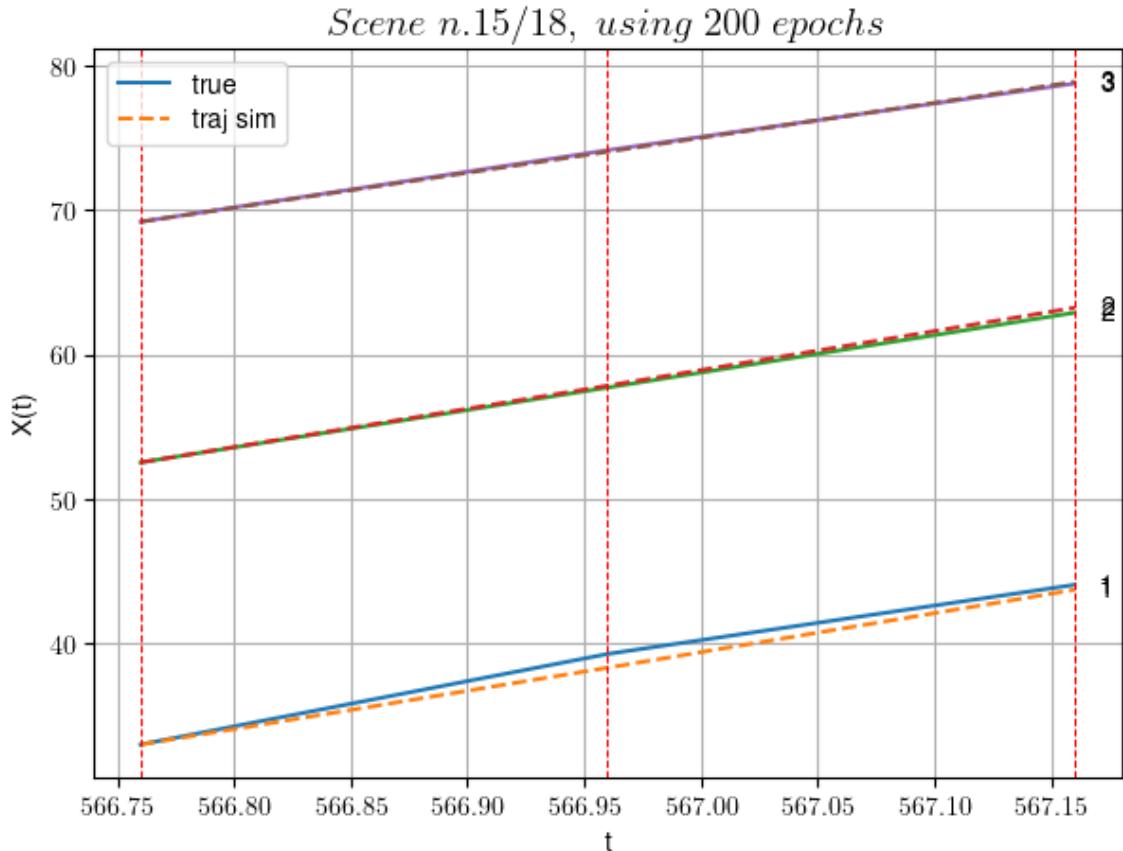
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Scene n.15/18, time interval:[566.76,567.16]

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Loss: 0.13229562802013756  
v0 updated: 24.228864140655777

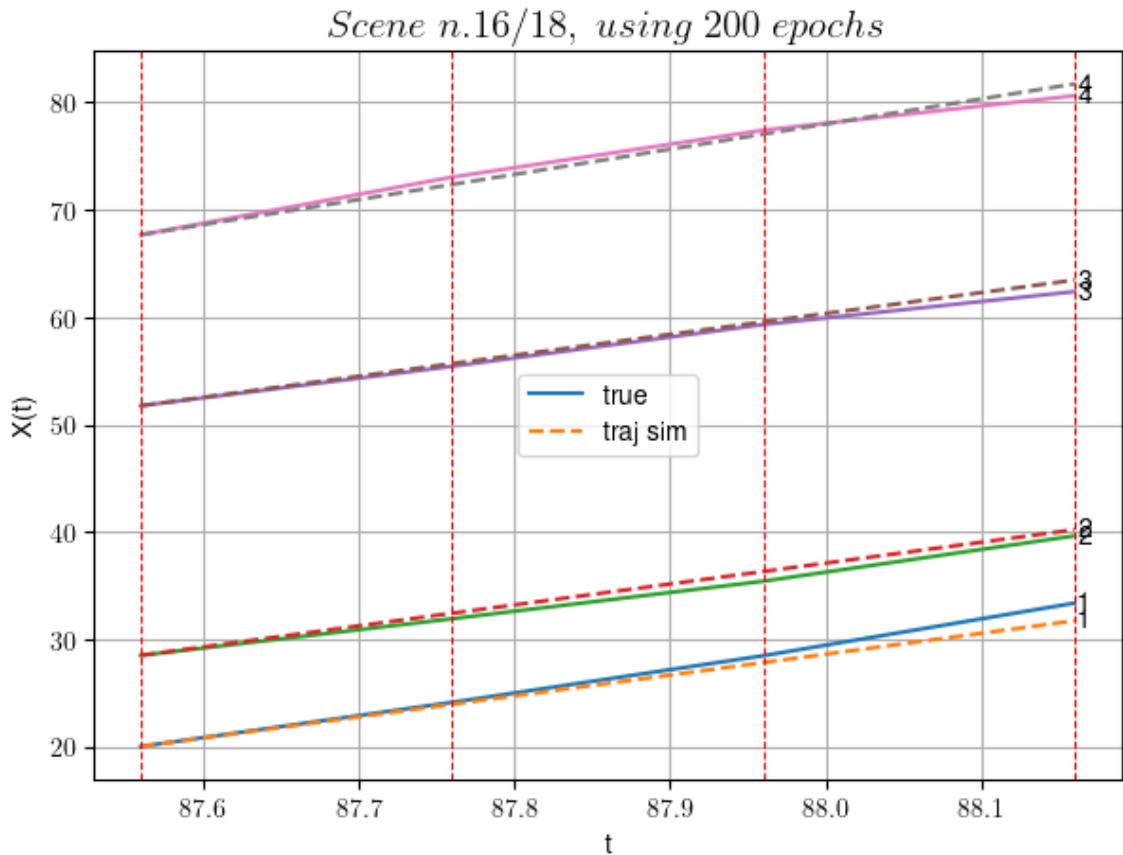
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Scene n.16/18, time interval:[87.56,88.16]

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Loss: 0.4802973314578022  
v0 updated: 23.439775970163954

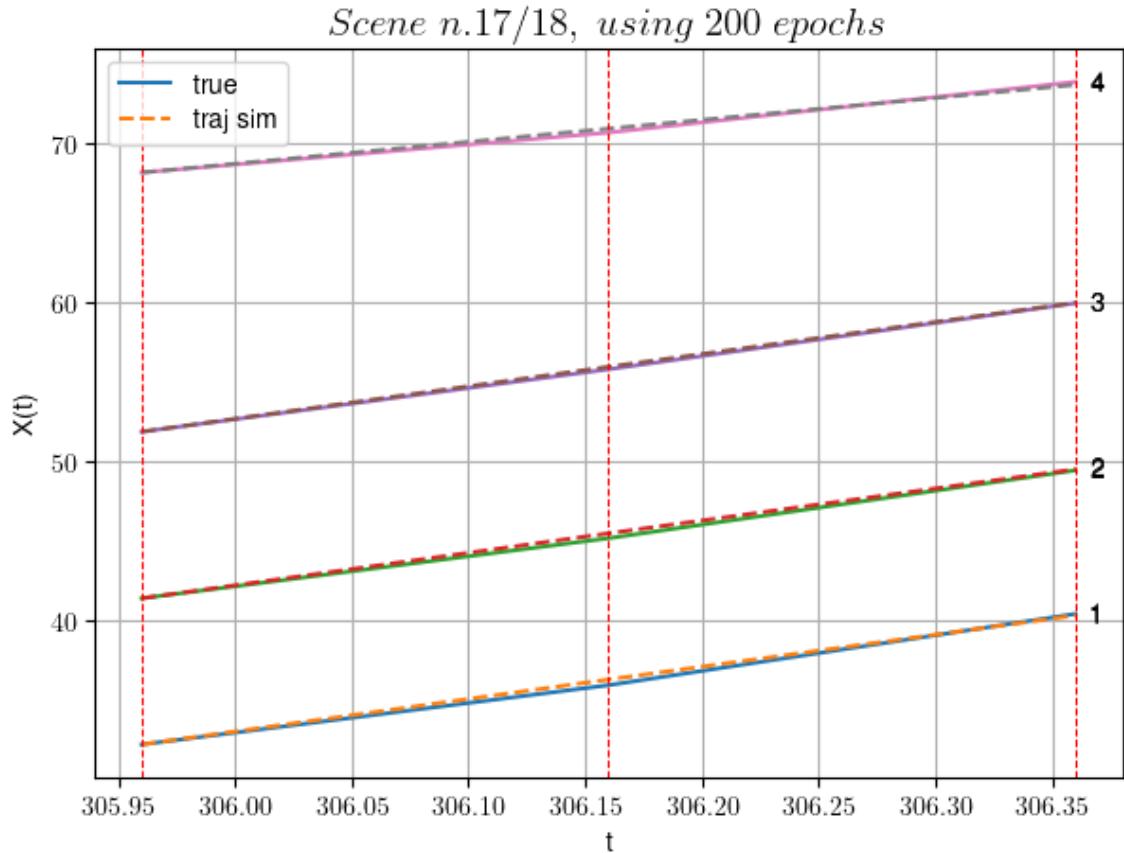
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Scene n.17/18, time interval:[305.96,306.36]

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Loss: 0.0298213442435897  
 v0 updated: 13.781892213856752

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v0\_mean in this df is: 21.567993269996162  
 Time taken: 101.49s  
 Hidden-Layer-1/kernel:0: [-1543128.6 -2946.929]  
 Hidden-Layer-1/bias:0: [-76481.914 -237.7462]  
 Output-Layer/kernel:0: [-1.2088498e+06 -3.2554160e+02]  
 Output-Layer/bias:0: [20.41999]

---



---

In df n.3/10 we have 55 scenes

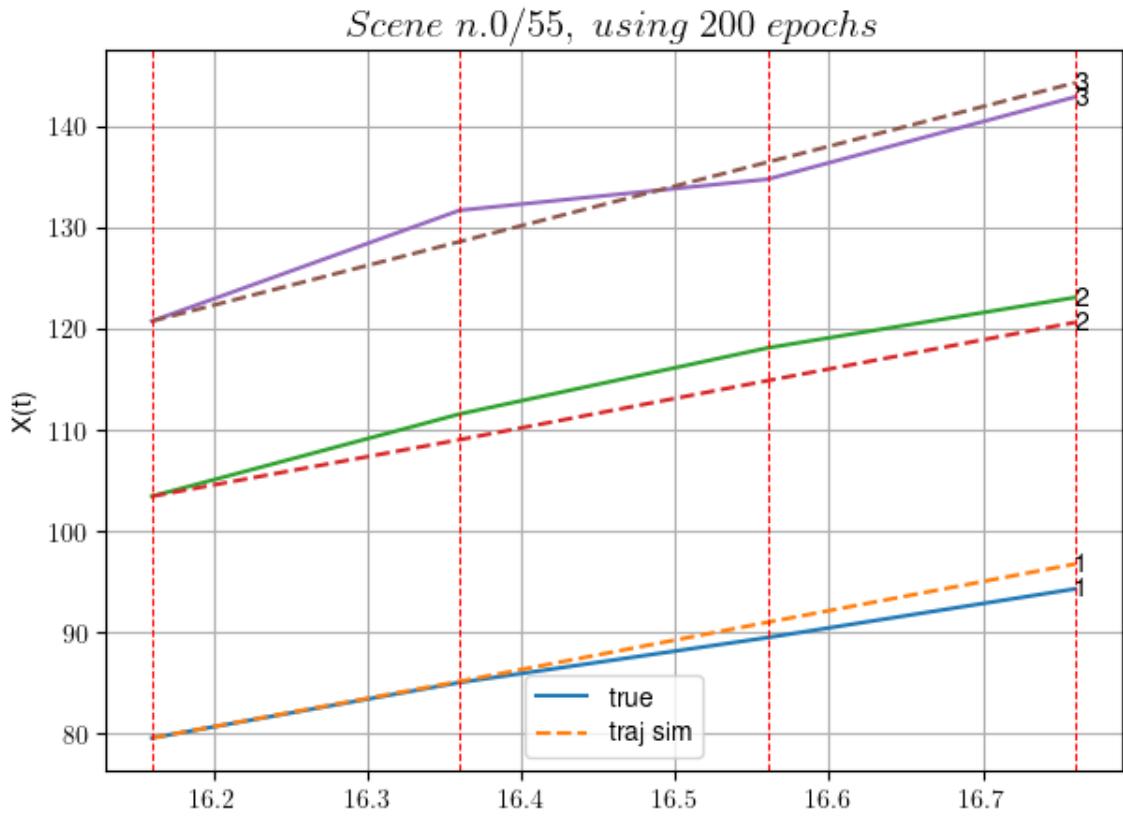
---

Scene n.0/55, time interval:[16.16,16.76]

---



---



Loss: 3.7991360945348824  
v0 updated: 39.21715010860685

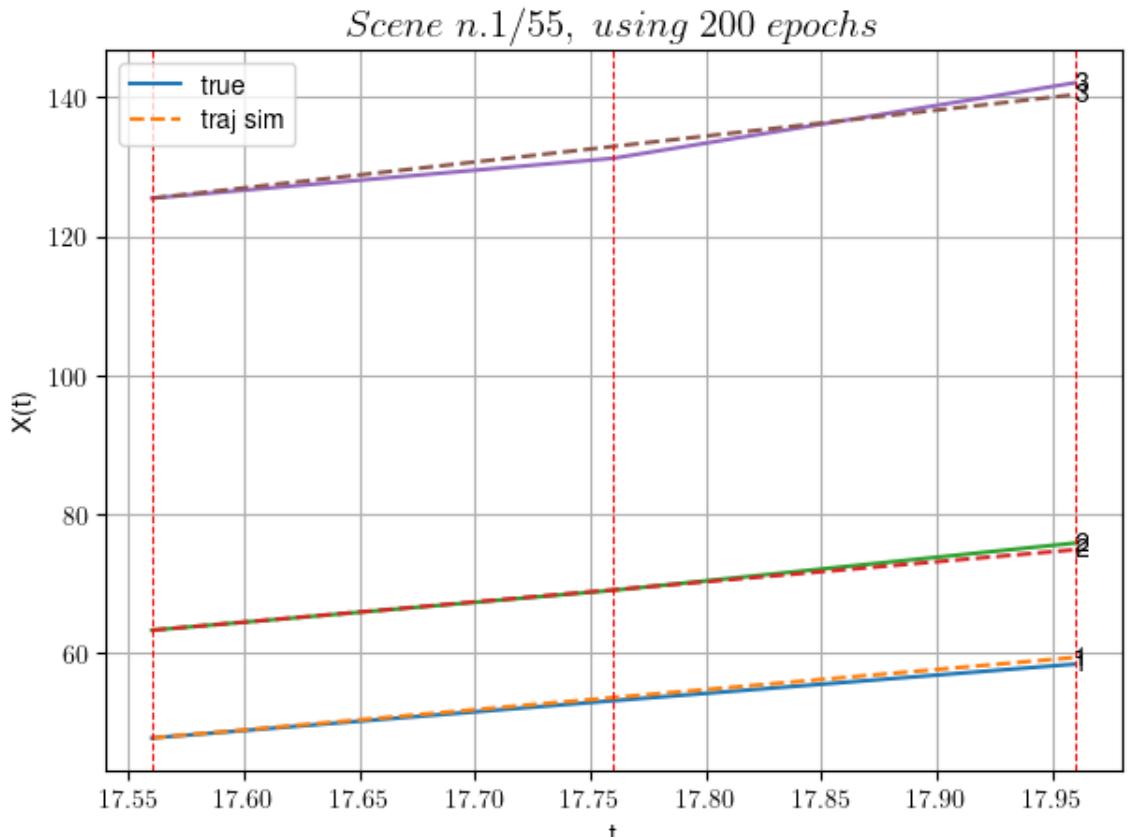
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Scene n.1/55, time interval:[17.56,17.96]

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---



Loss: 0.8741189295498938  
v0 updated: 37.33354775754679

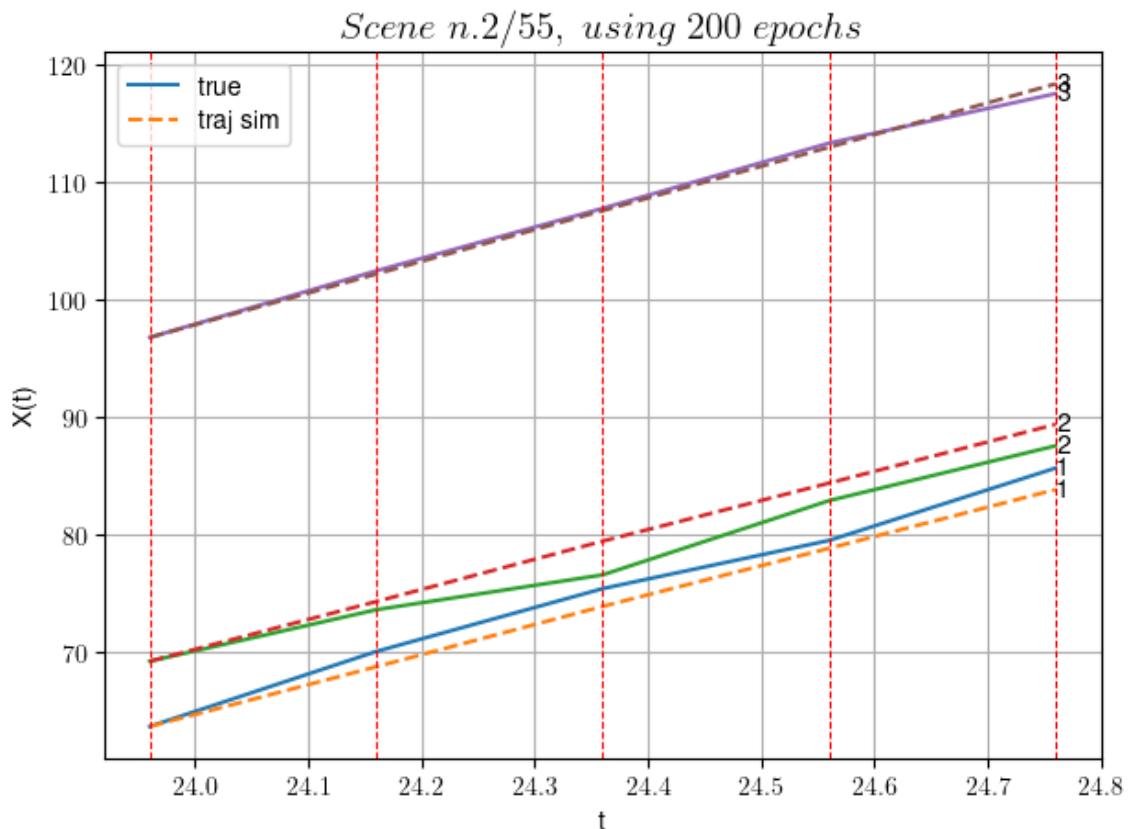
---

---

Scene n.2/55, time interval:[23.96,24.76]

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---



Loss: 1.5372380915338943  
v0 updated: 27.019940095947995

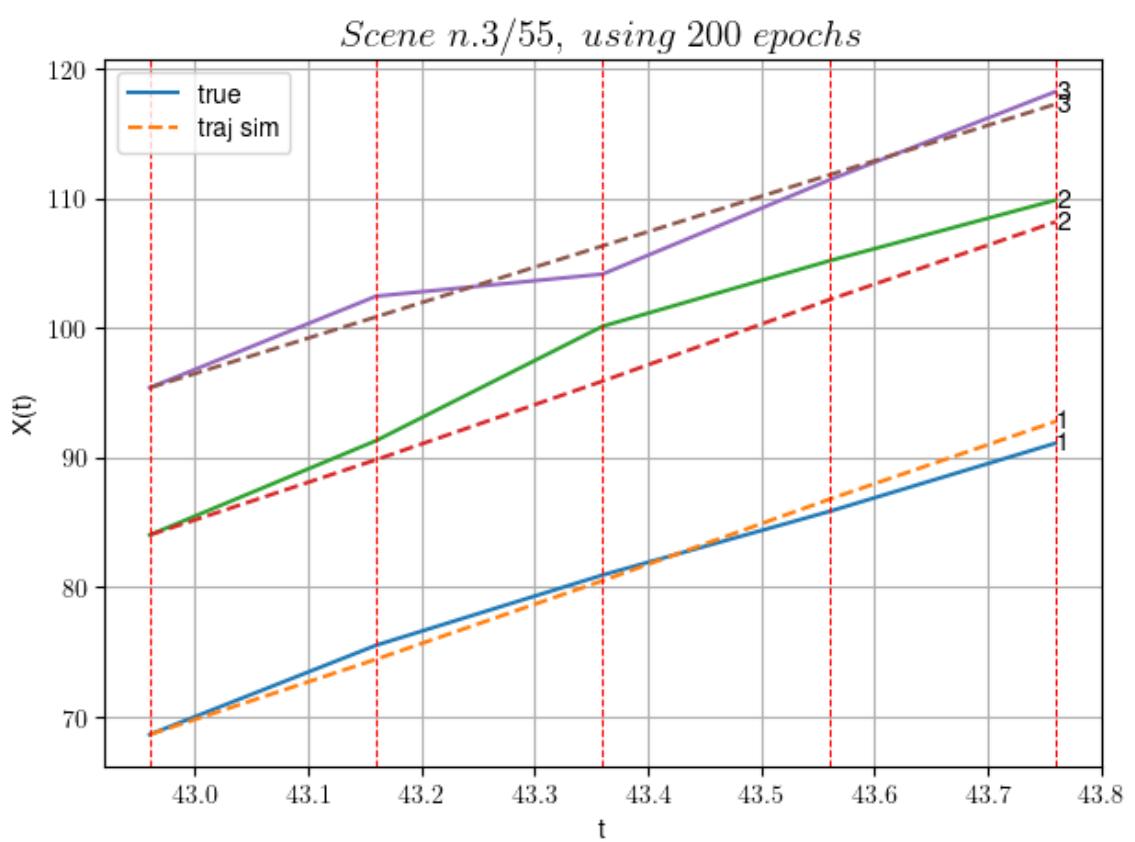
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---

Scene n.3/55, time interval:[42.96,43.76]

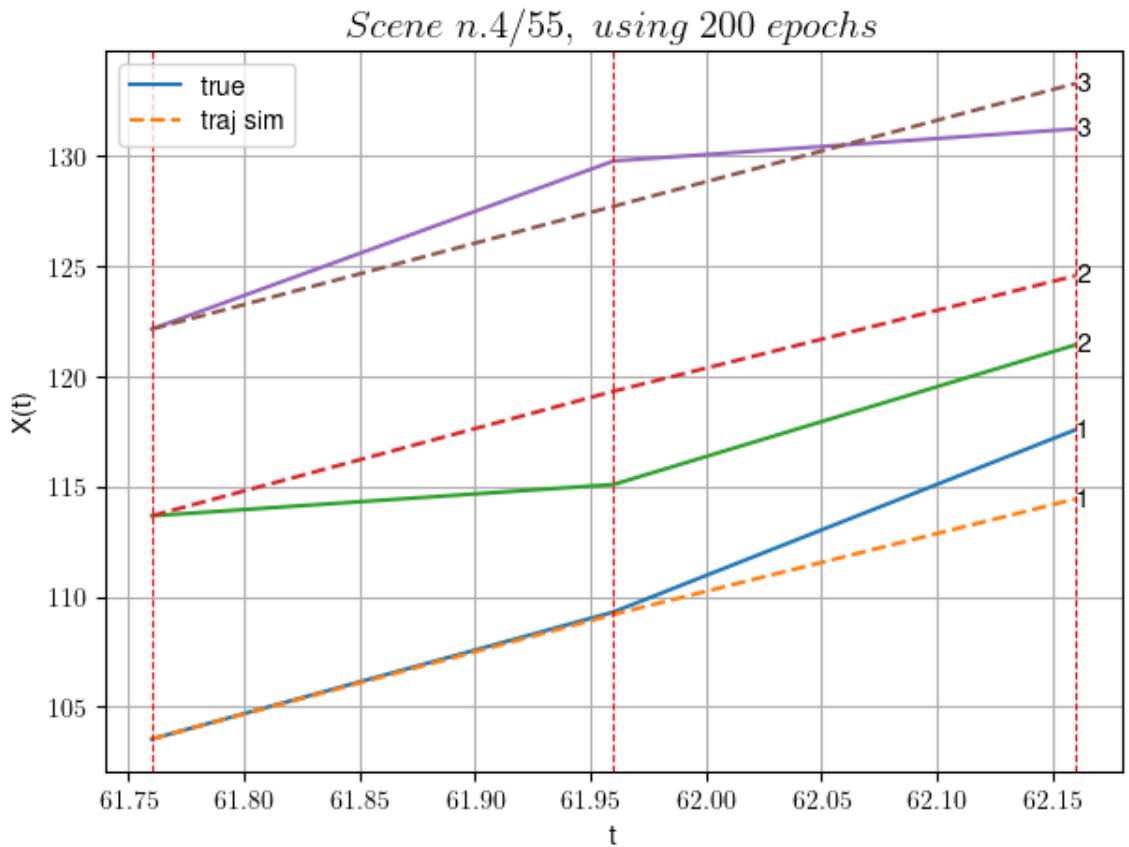
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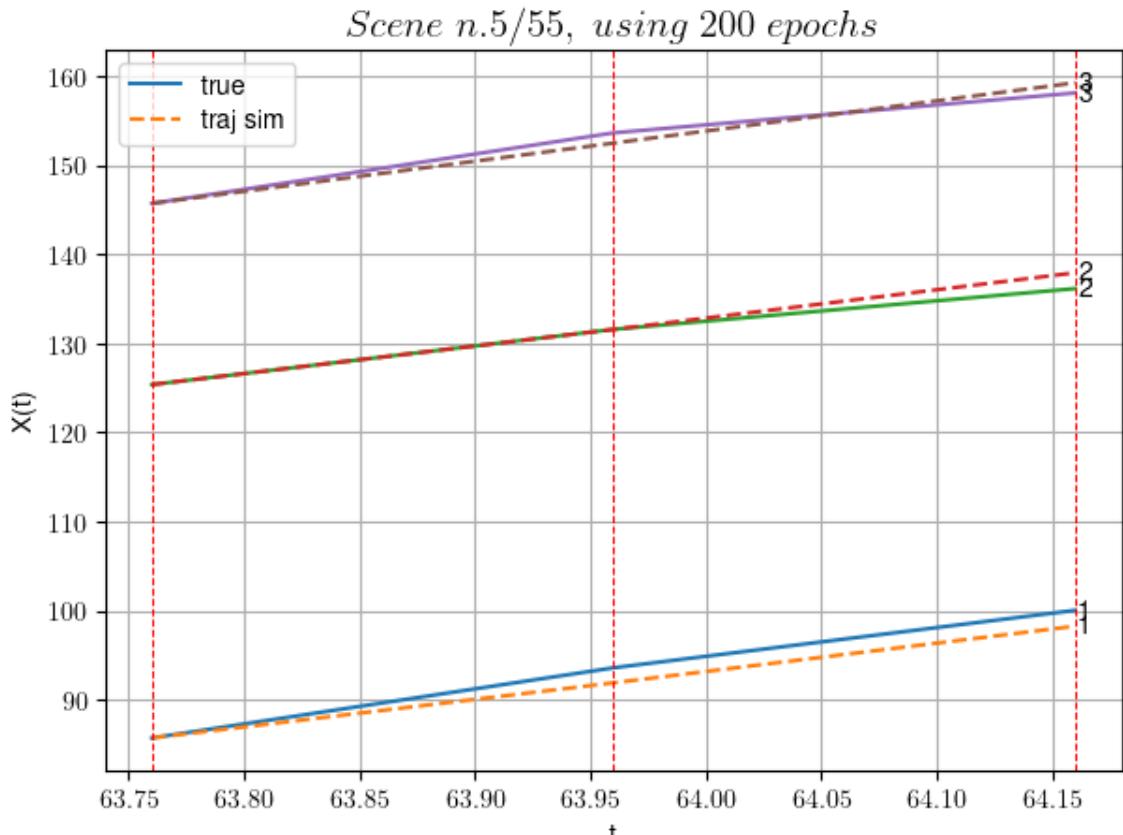
Loss: 3.020812925927542  
v0 updated: 27.353582436749843

Scene n.4/55, time interval:[61.76,62.16]



Loss: 5.1091522333777695  
v0 updated: 27.832473006374567

Scene n.5/55, time interval:[63.76,64.16]



Loss: 1.3038301450132919  
v0 updated: 33.83566643209178

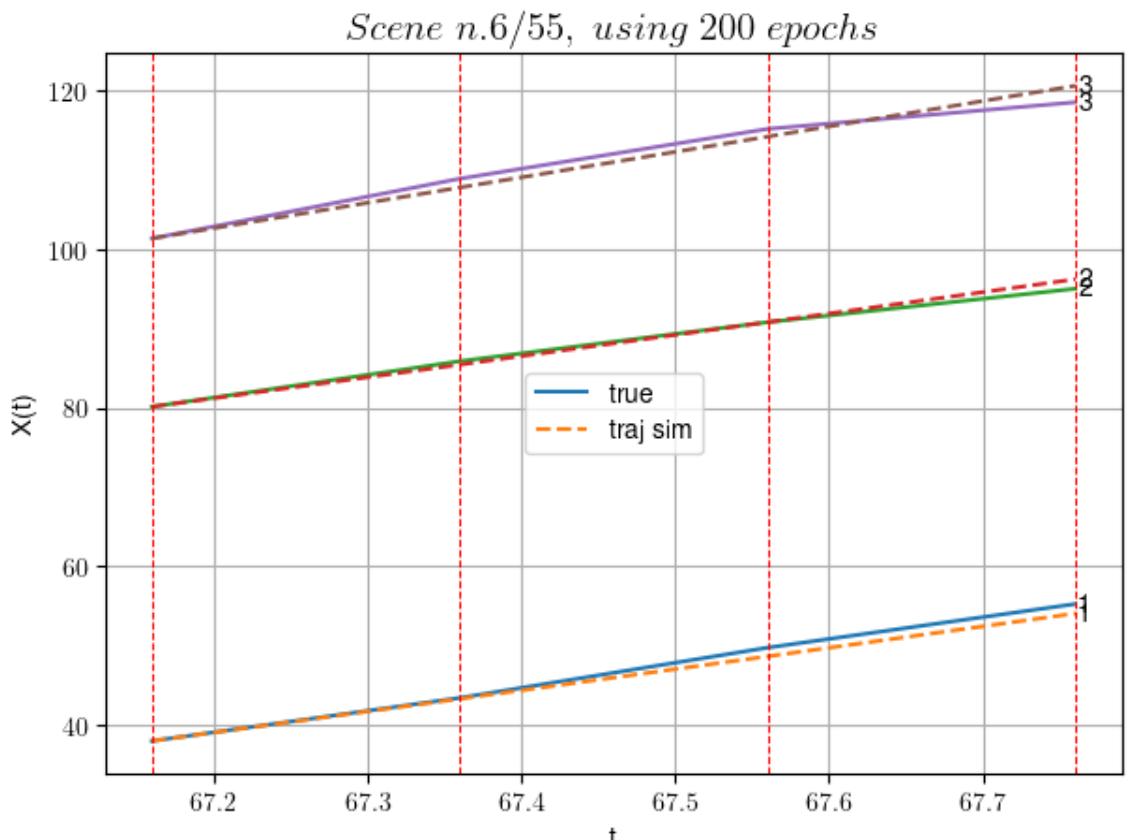
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Scene n.6/55, time interval:[67.16,67.76]

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Loss: 0.9009057483640293  
v0 updated: 32.13697253892425

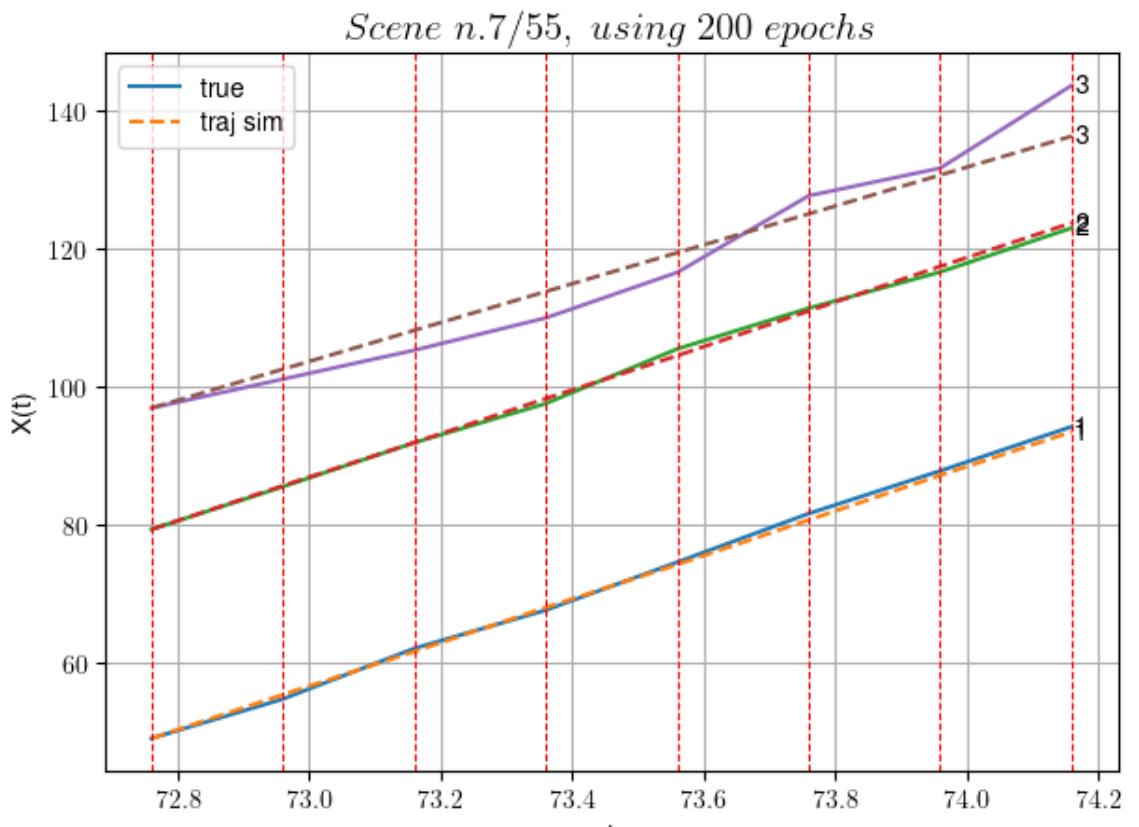
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---

Scene n.7/55, time interval:[72.76,74.16]

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Loss: 4.192558058096769  
v0 updated: 28.12330316633905

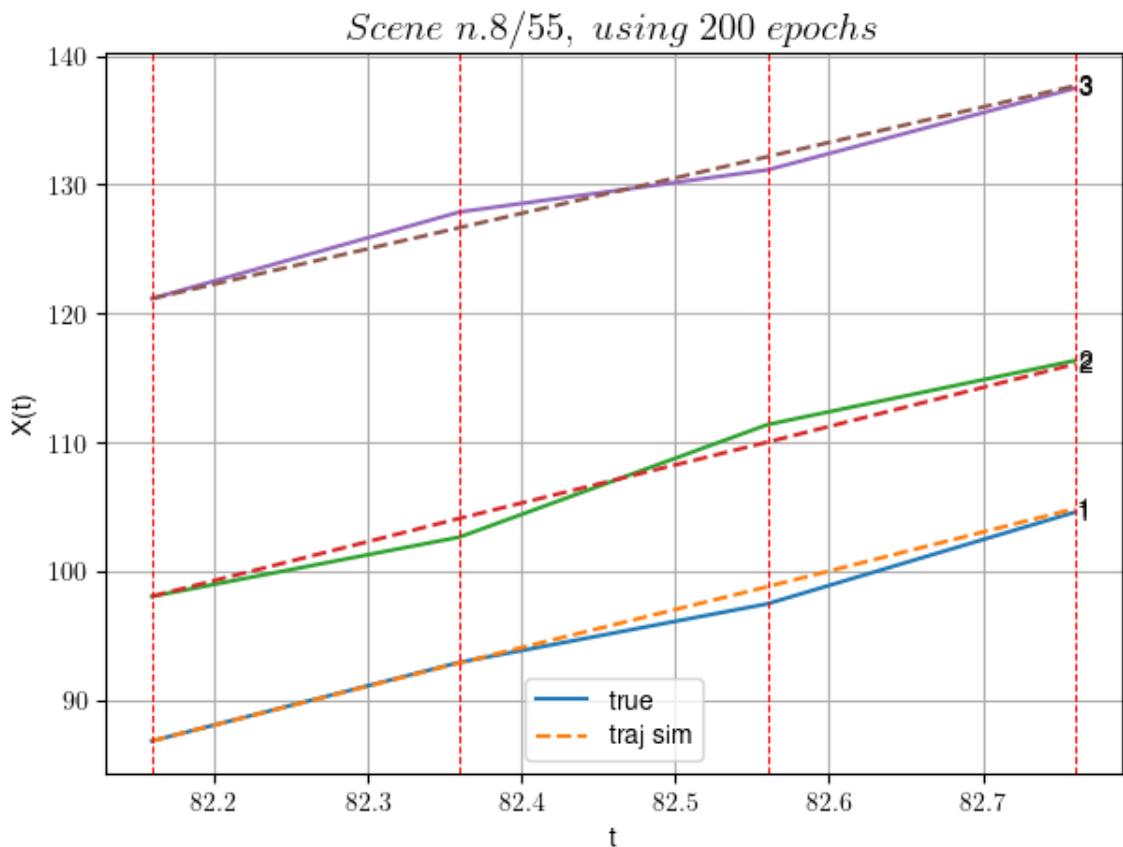
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Scene n.8/55, time interval:[82.16,82.76]

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Loss: 0.7045020146873151  
v0 updated: 27.552927285636404

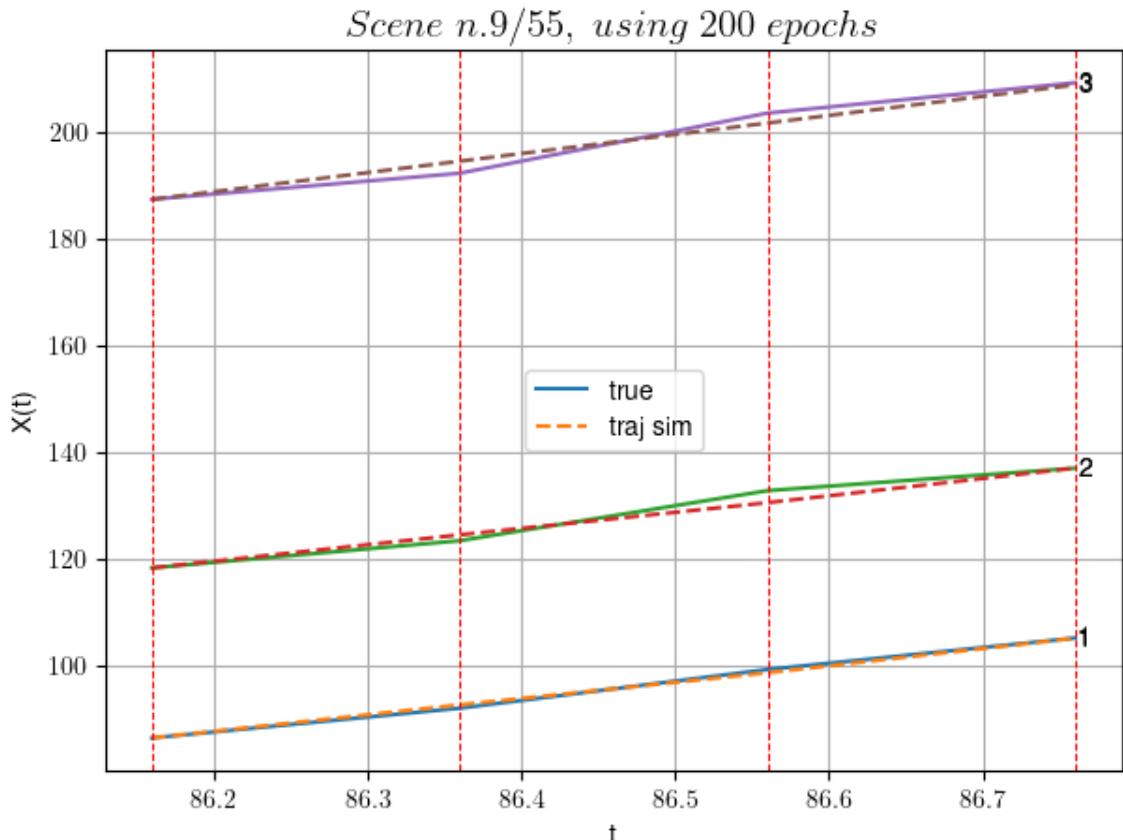
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Scene n.9/55, time interval:[86.16,86.76]

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Loss: 1.3144505416562786  
v0 updated: 35.758406855917755

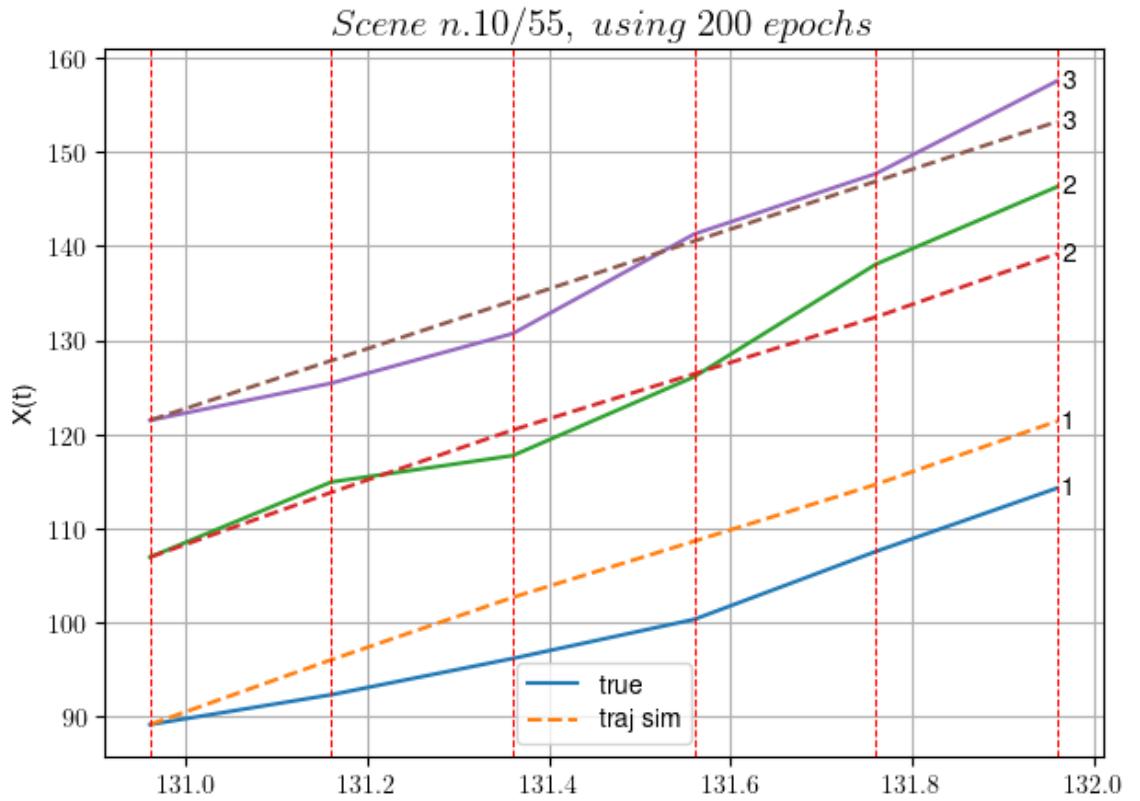
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Scene n.10/55, time interval:[130.96,131.96]

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Loss: 19.730305379289813  
v0 updated: 31.750413794800306

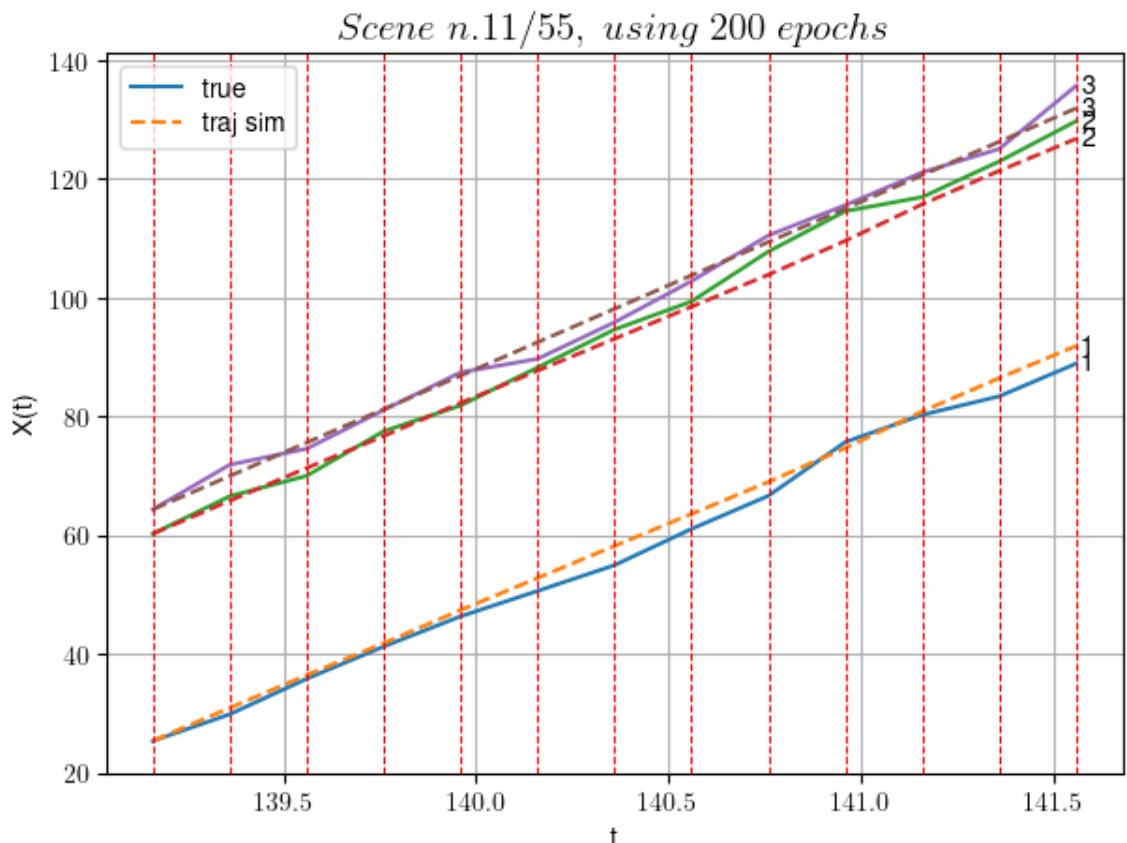
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Scene n.11/55, time interval:[139.16,141.56]

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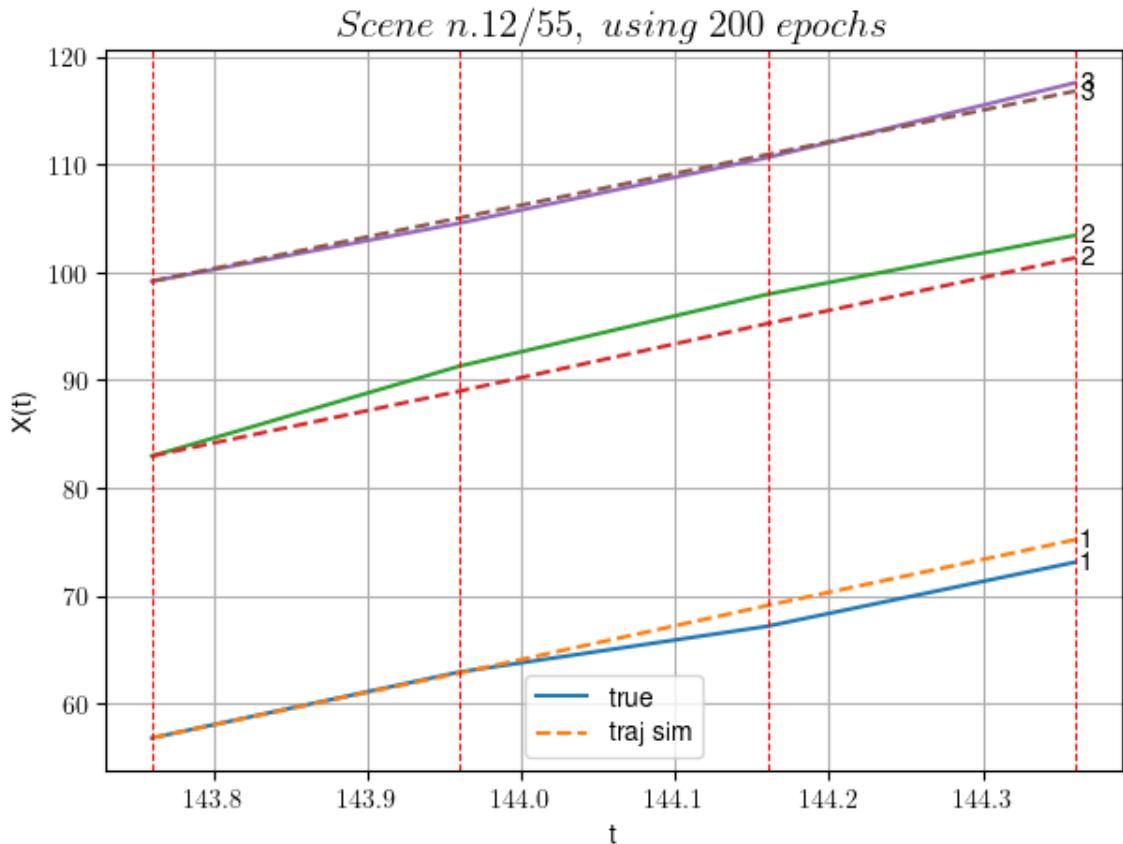


Loss: 3.7352272501796833  
v0 updated: 28.146667787591962

---

Scene n.12/55, time interval:[143.76,144.36]

---



Loss: 2.174639747026396  
v0 updated: 29.41538708161572

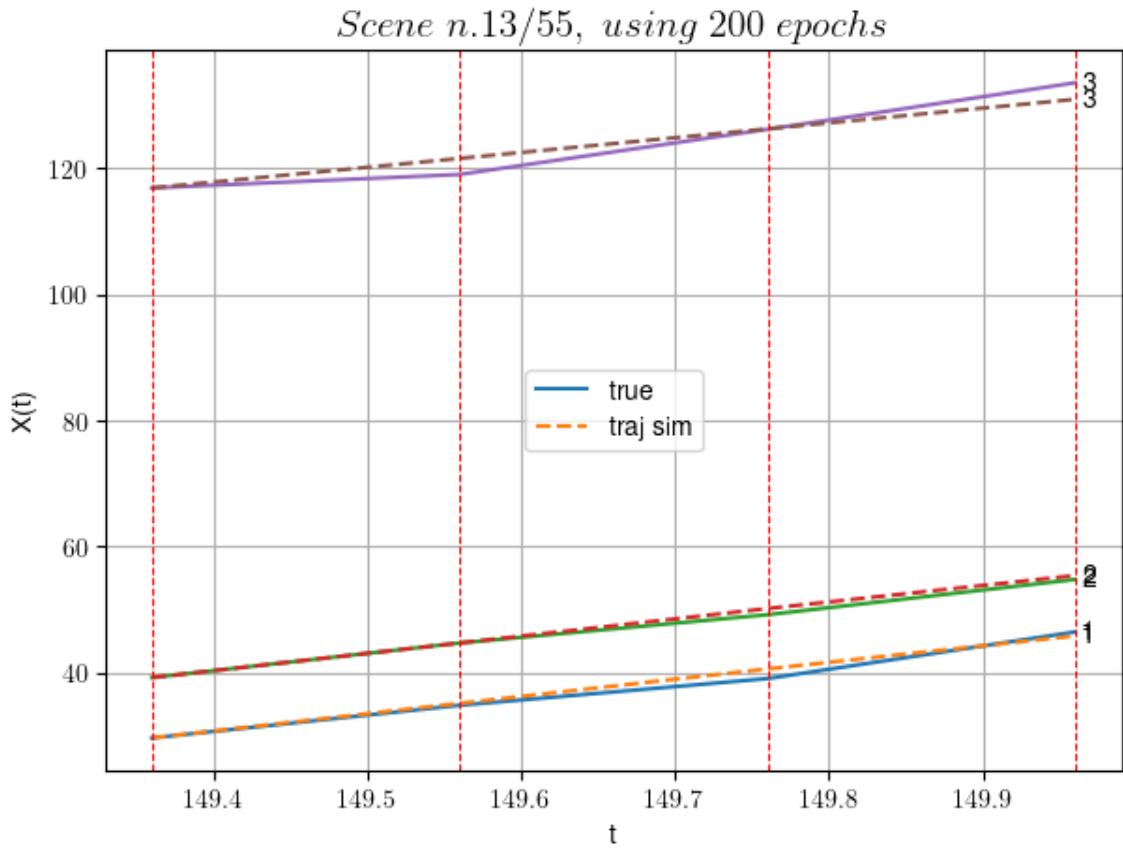
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Scene n.13/55, time interval:[149.36,149.96]

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Loss: 1.4649157223513163  
v0 updated: 23.450754392043912

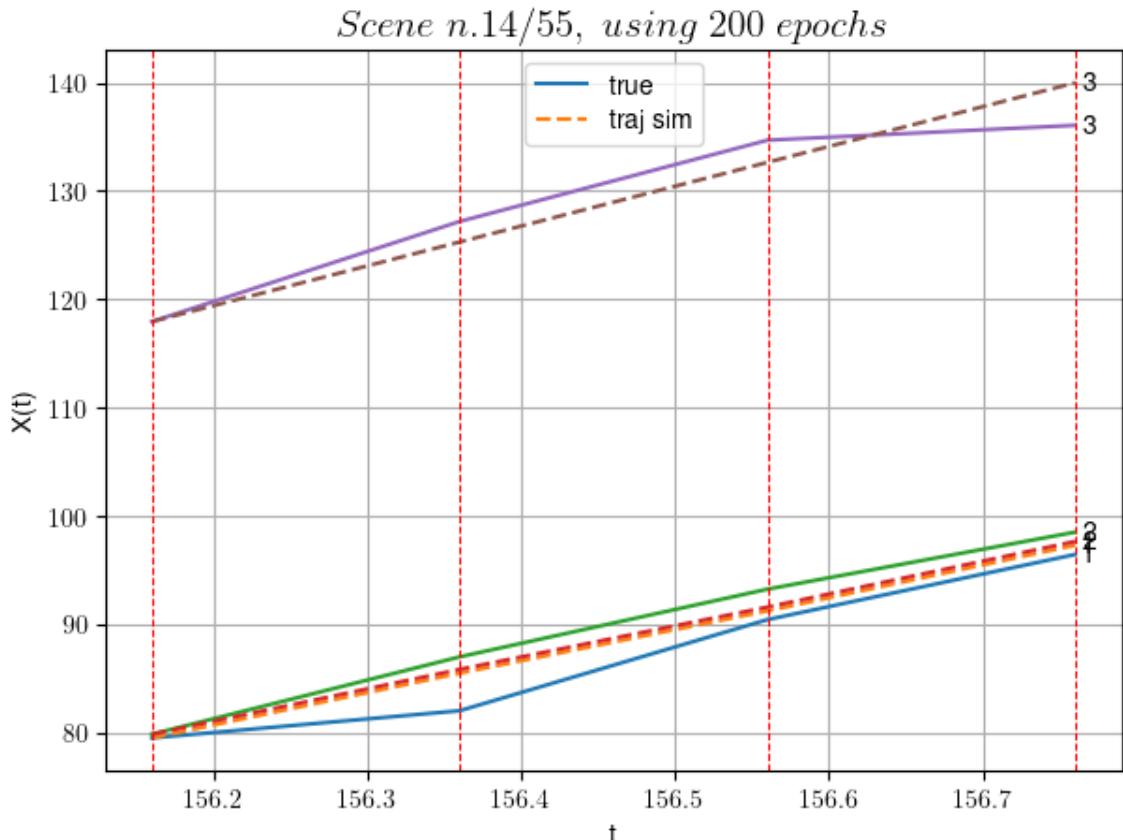
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Scene n.14/55, time interval:[156.16,156.76]

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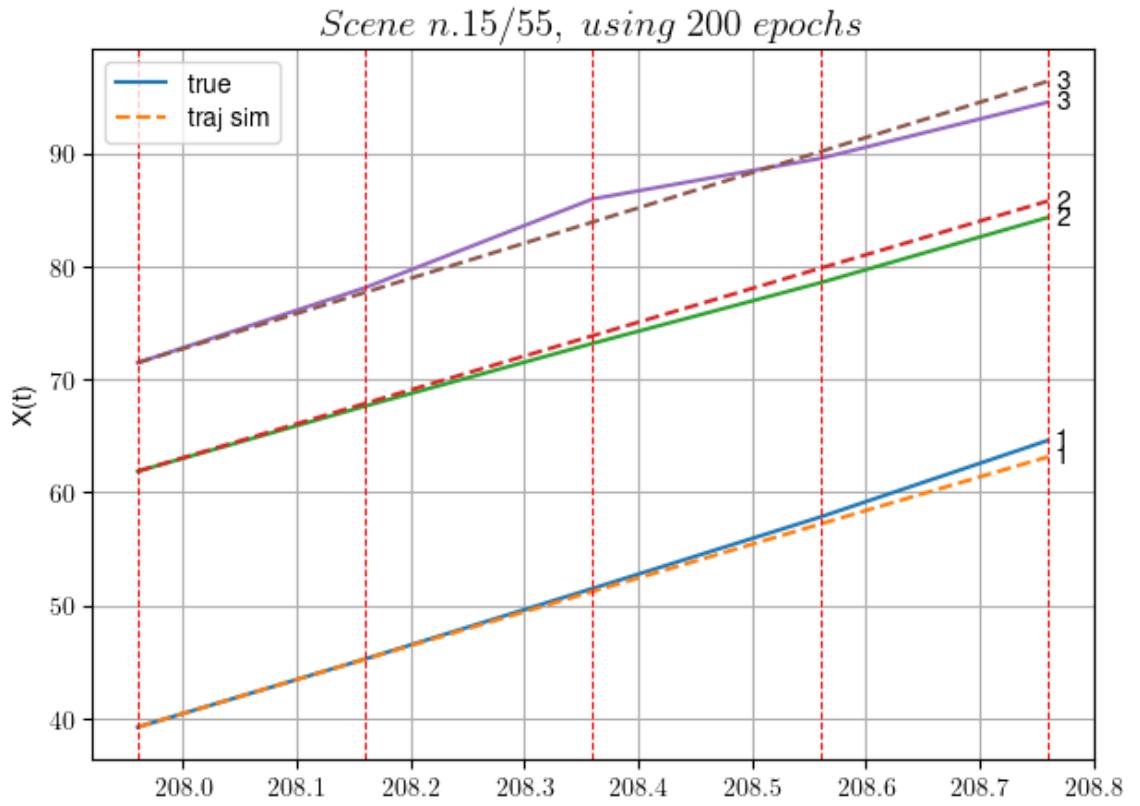


Loss: 3.4597553972800372  
v0 updated: 36.77217279713218

---

Scene n.15/55, time interval:[207.96,208.76]

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Loss: 0.9968770072551134  
v0 updated: 31.123674479426654

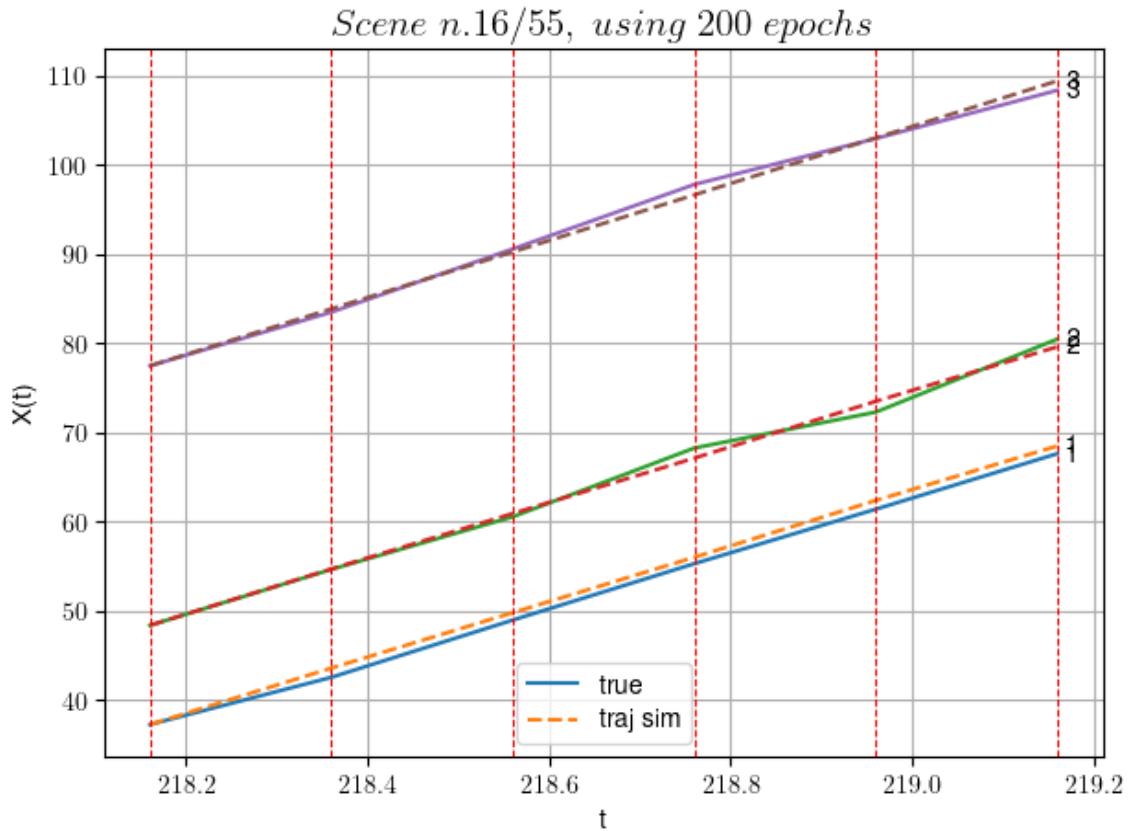
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Scene n.16/55, time interval:[218.16,219.16]

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Loss: 0.5731601246156511  
v0 updated: 31.94478783305763

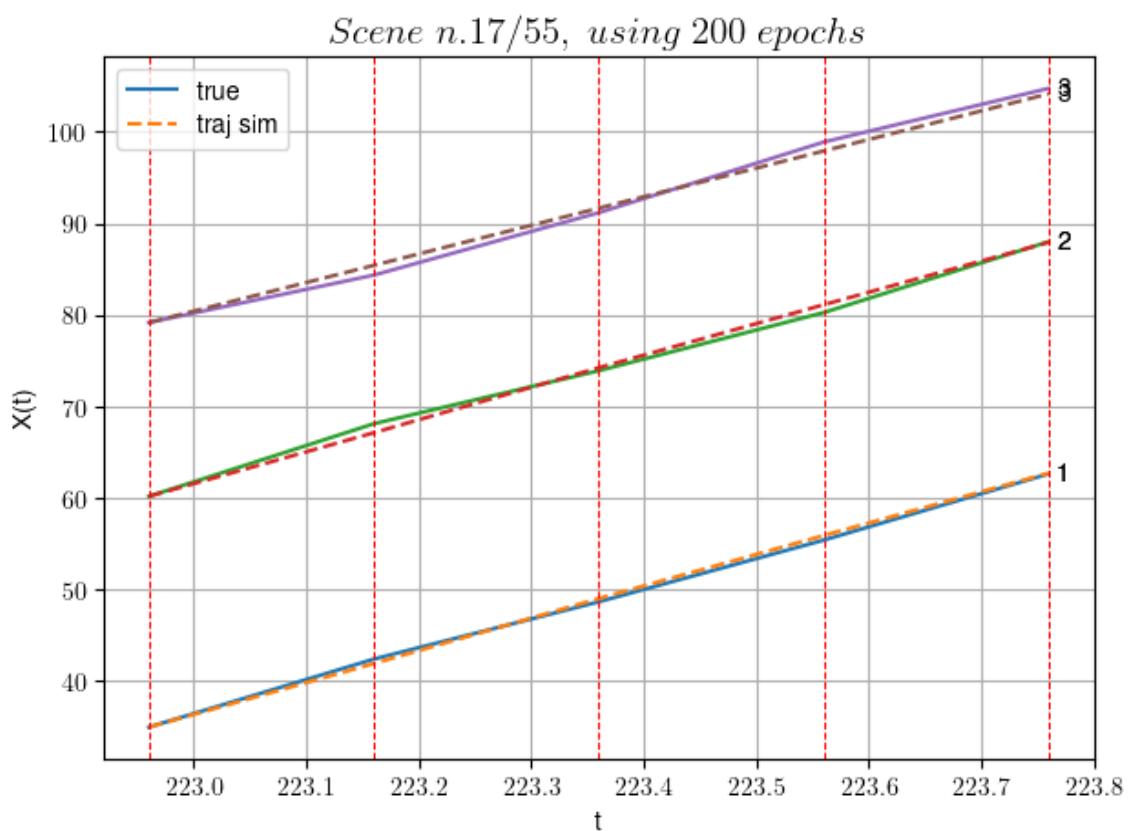
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Scene n.17/55, time interval:[222.96,223.76]

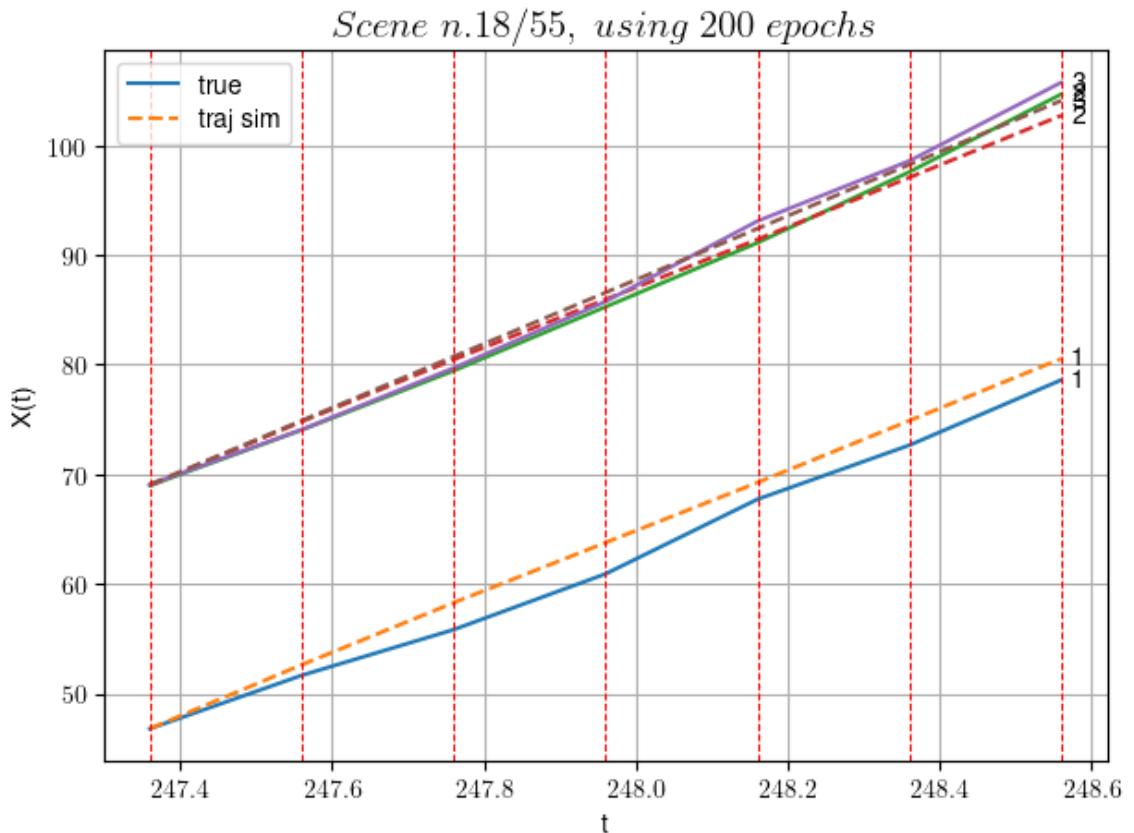
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Loss: 0.34102353018517834  
v0 updated: 31.27834550412877

Scene n.18/55, time interval:[247.36,248.56]



Loss: 1.8198916991019782  
v0 updated: 29.200424002930276

Scene n.19/55, time interval:[269.56,270.96]



Loss: 0.6733795875888634  
v0 updated: 30.538583647650018

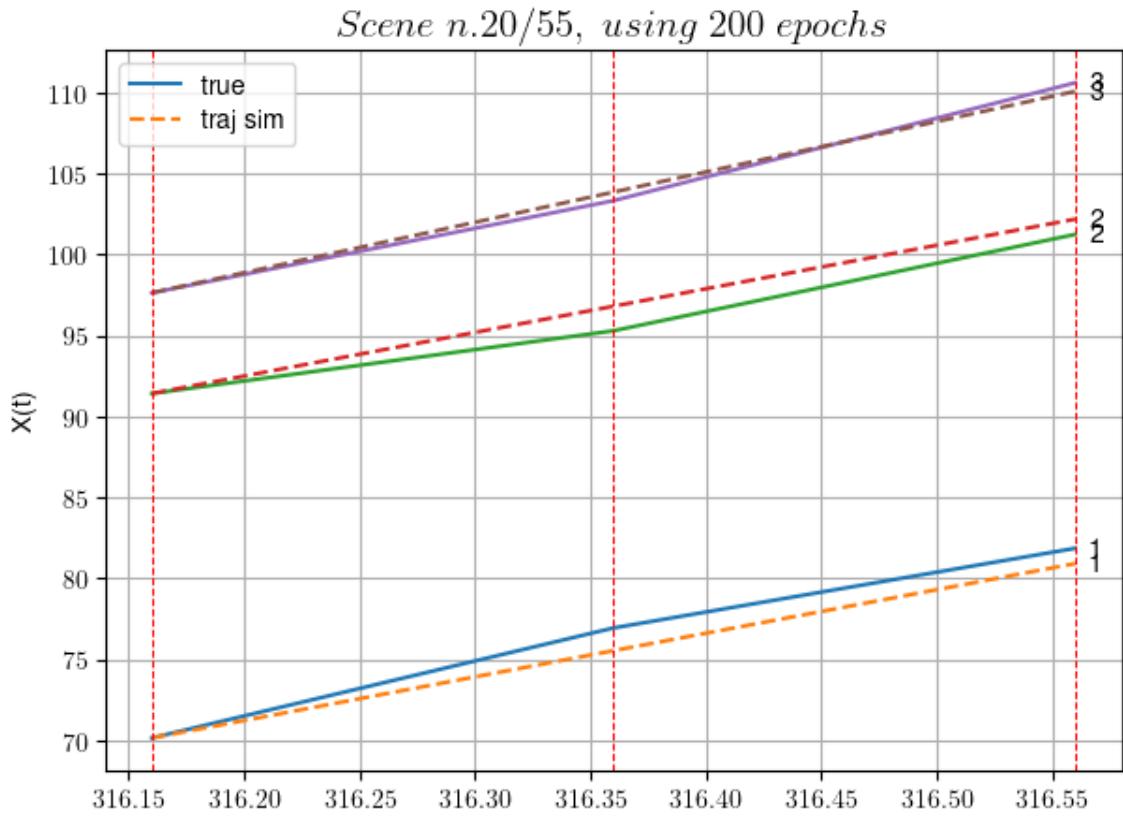
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Scene n.20/55, time interval:[316.16,316.56]

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Loss: 0.7338952924830976  
v0 updated: 31.118501827373837

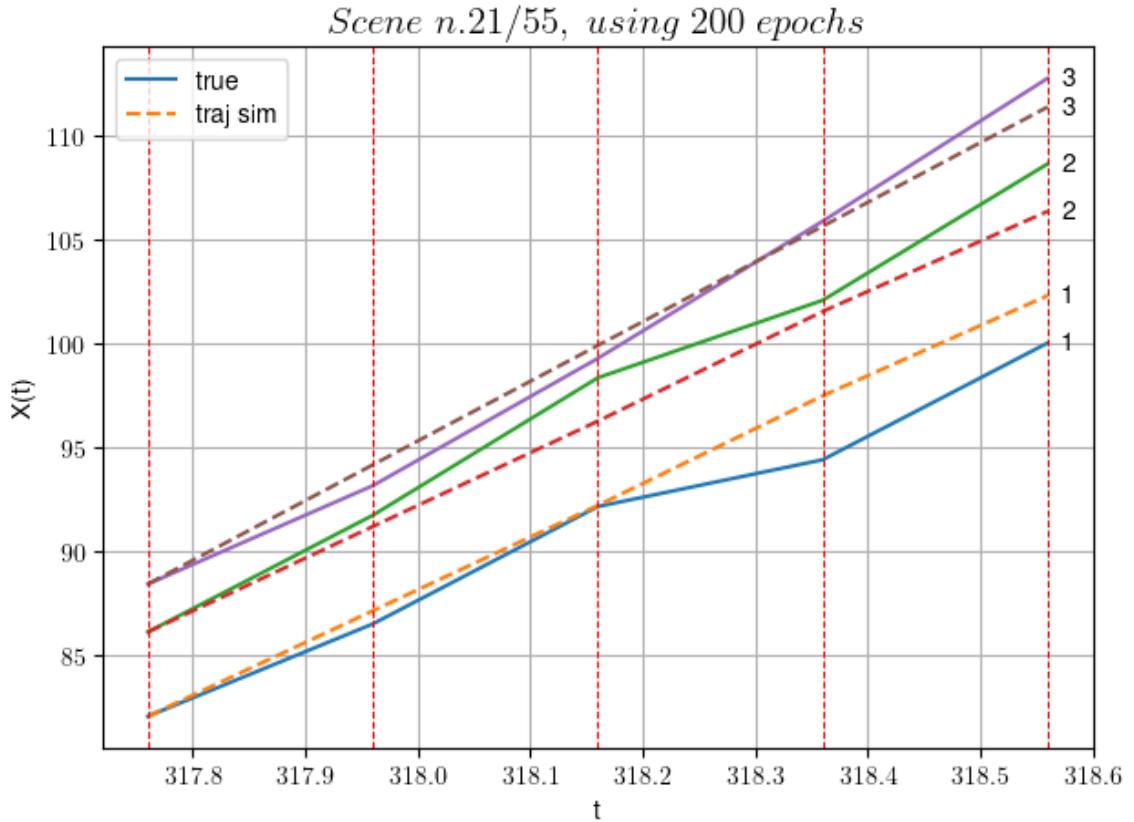
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Scene n.21/55, time interval:[317.76,318.56]

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Loss: 1.9089886827106757  
v0 updated: 28.731001411505467

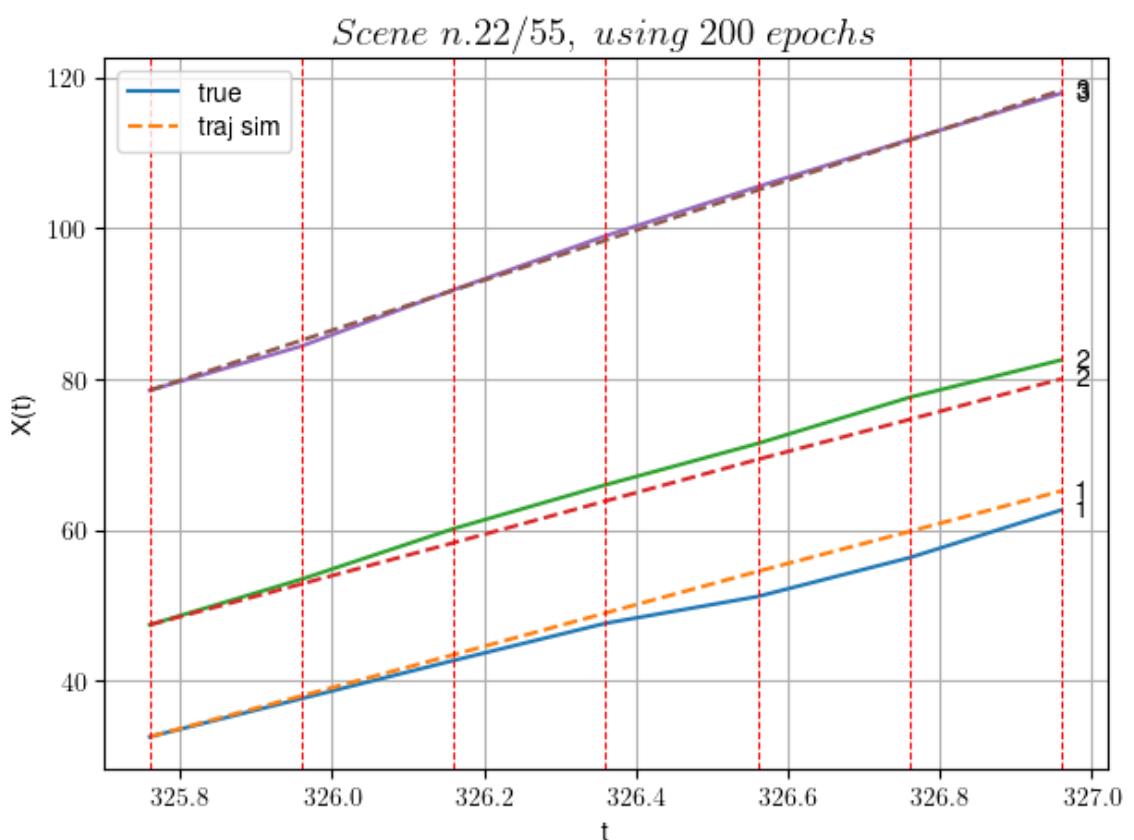
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Scene n.22/55, time interval:[325.76,326.96]

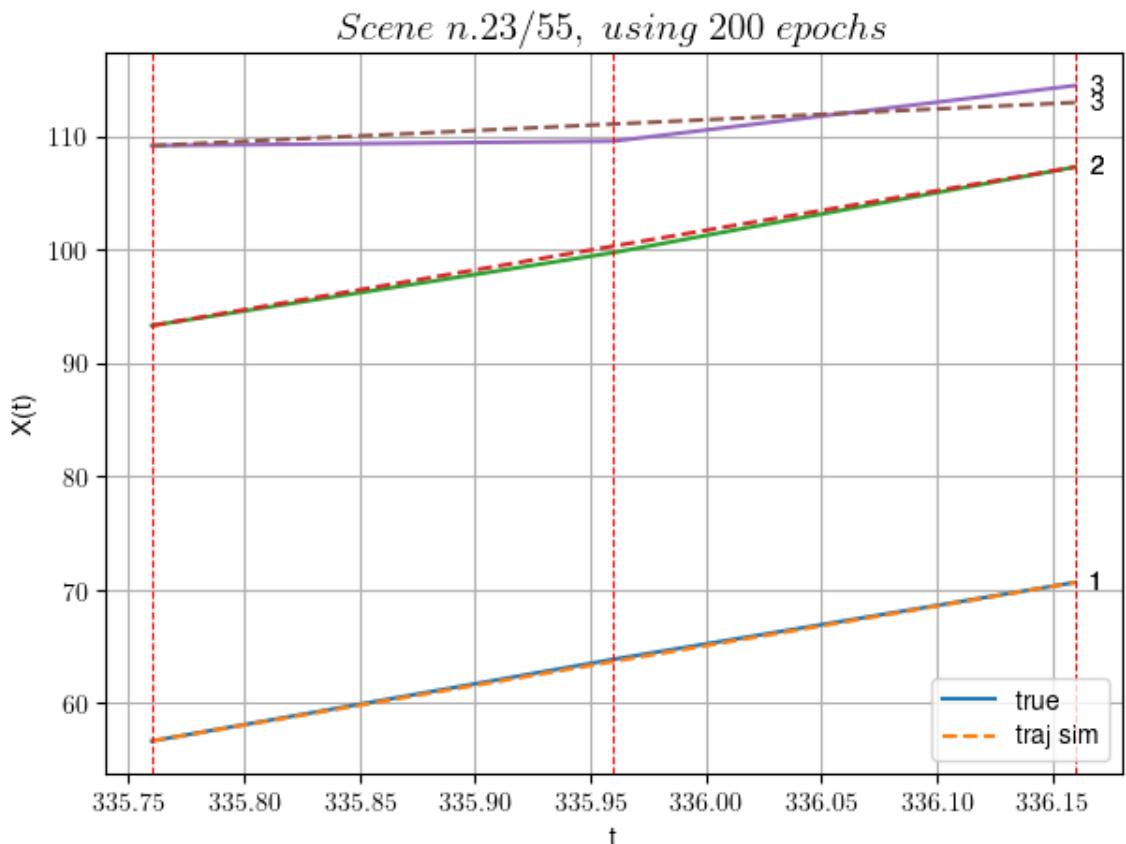
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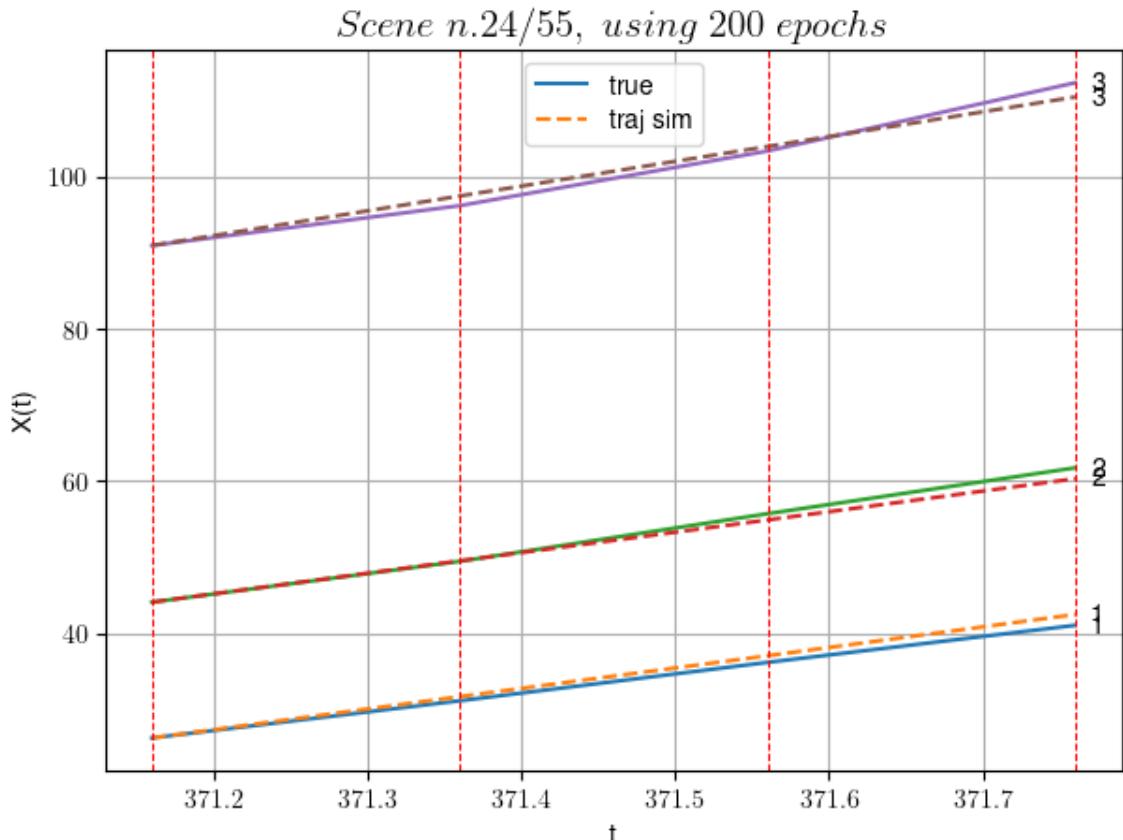
Loss: 2.9129313295933734  
v0 updated: 33.13210942893414

Scene n.23/55, time interval:[335.76,336.16]



Loss: 0.5398193119908694  
v0 updated: 9.51819454011644

Scene n.24/55, time interval:[371.16,371.76]



Loss: 0.93868427497265  
v0 updated: 32.53671918608213

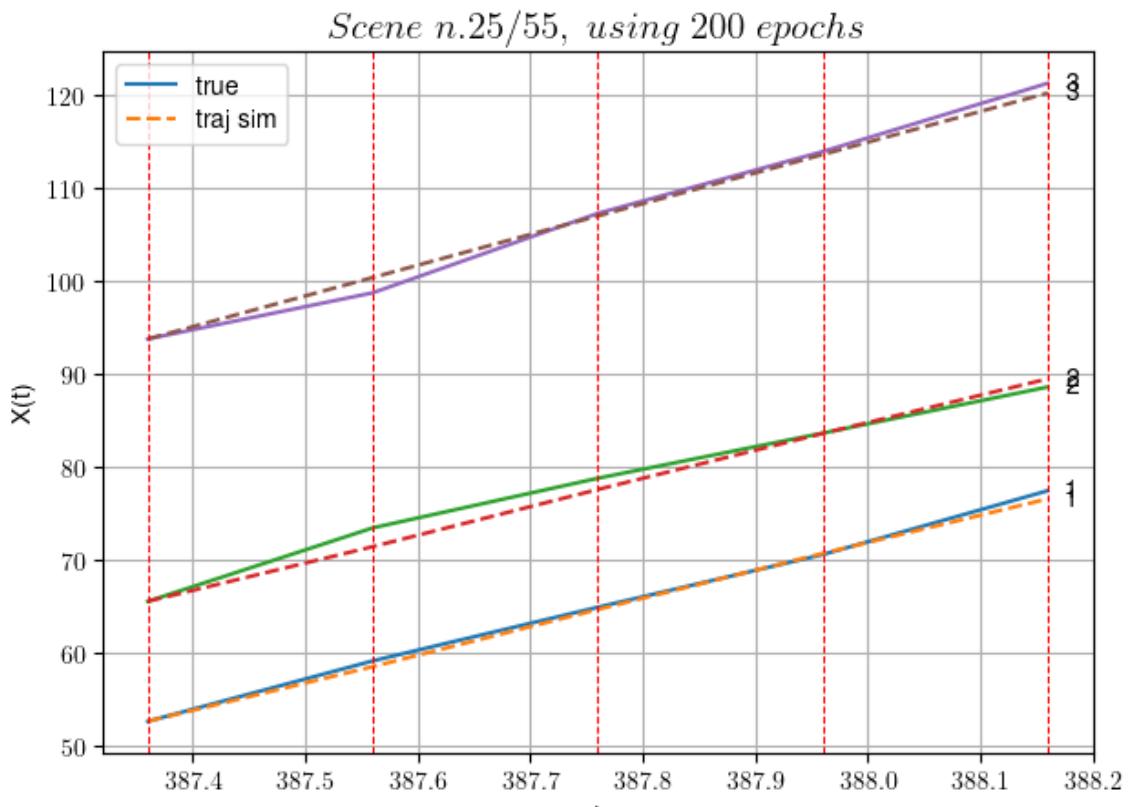
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Scene n.25/55, time interval:[387.36,388.16]

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Loss: 0.7667661385413199  
v0 updated: 33.02856902380123

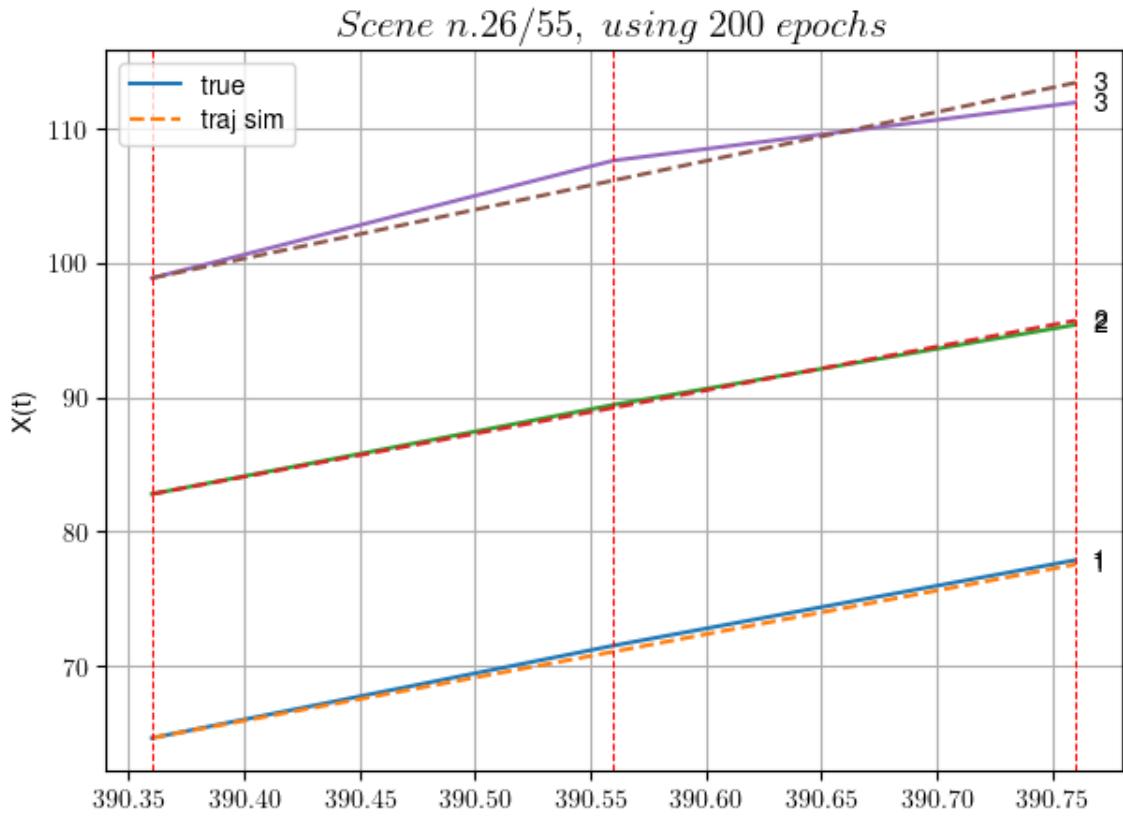
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Scene n.26/55, time interval:[390.36,390.76]

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Loss: 0.5367480781255706  
v0 updated: 36.3472833737466

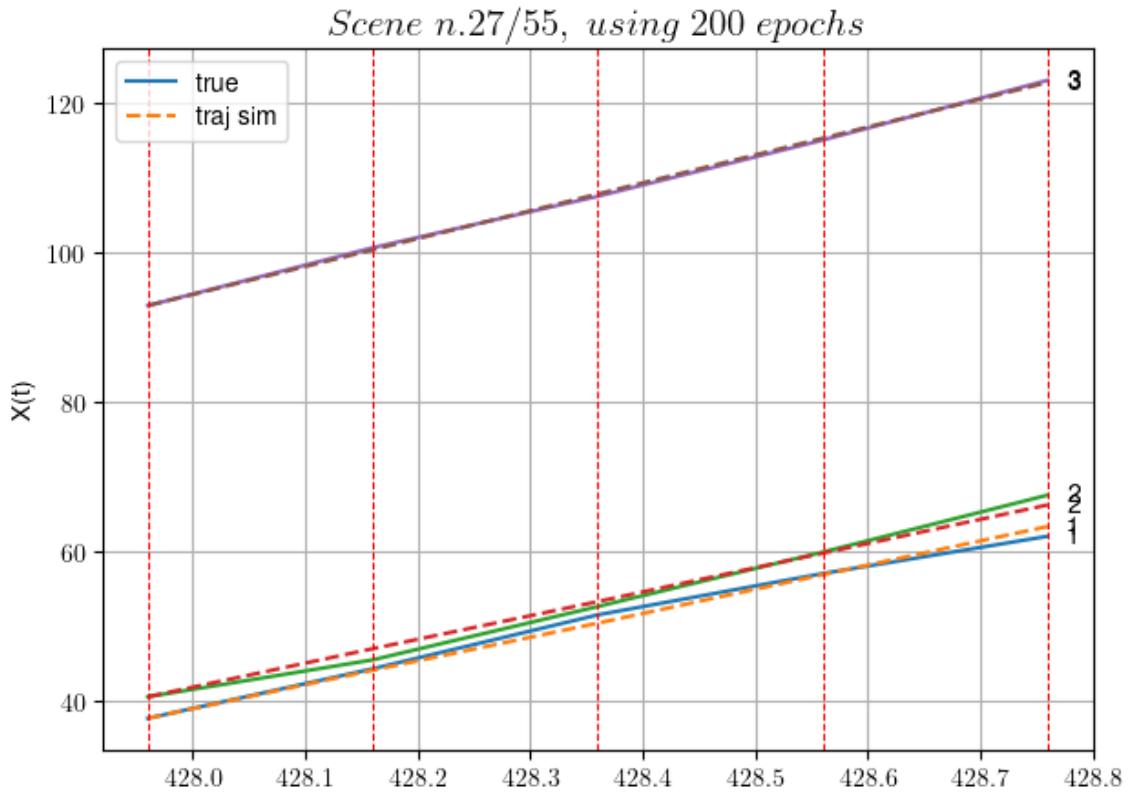
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Scene n.27/55, time interval:[427.96,428.76]

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Loss: 0.5171211457263327  
v0 updated: 37.34178593555988

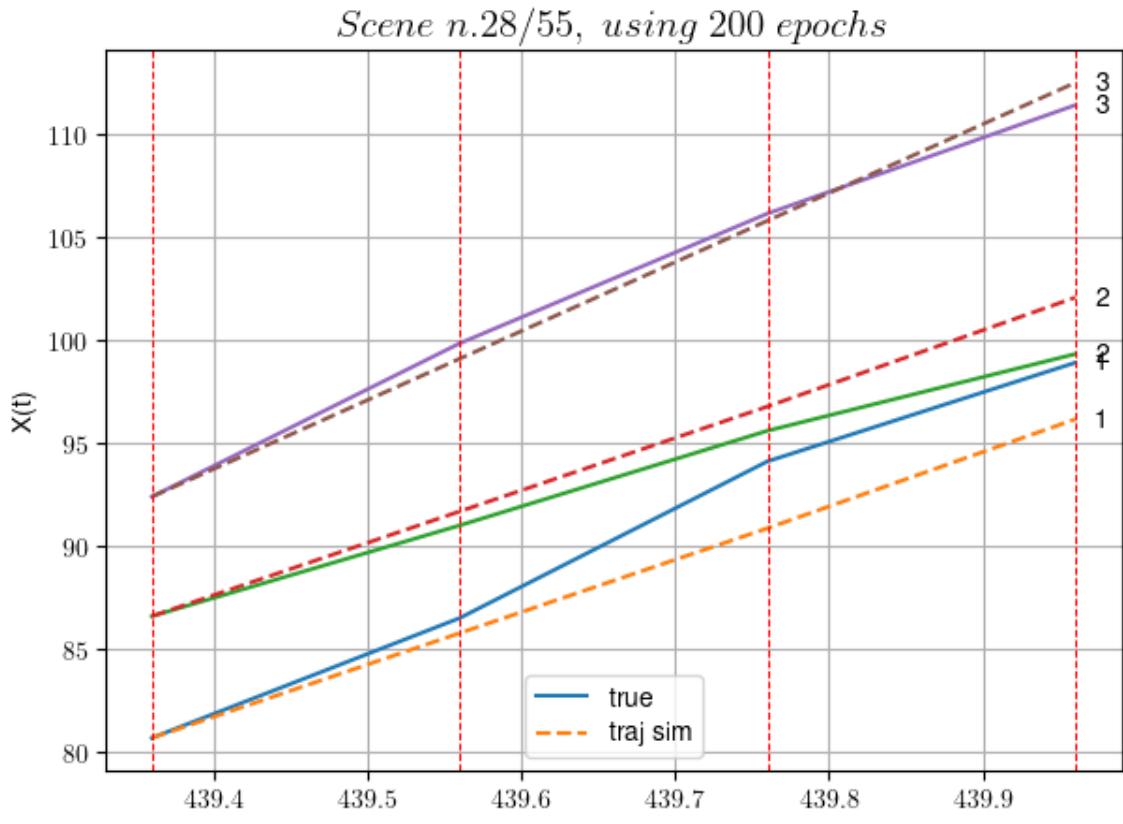
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Scene n.28/55, time interval:[439.36,439.96]

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Loss: 2.492687316067164  
v0 updated: 33.53249558198438

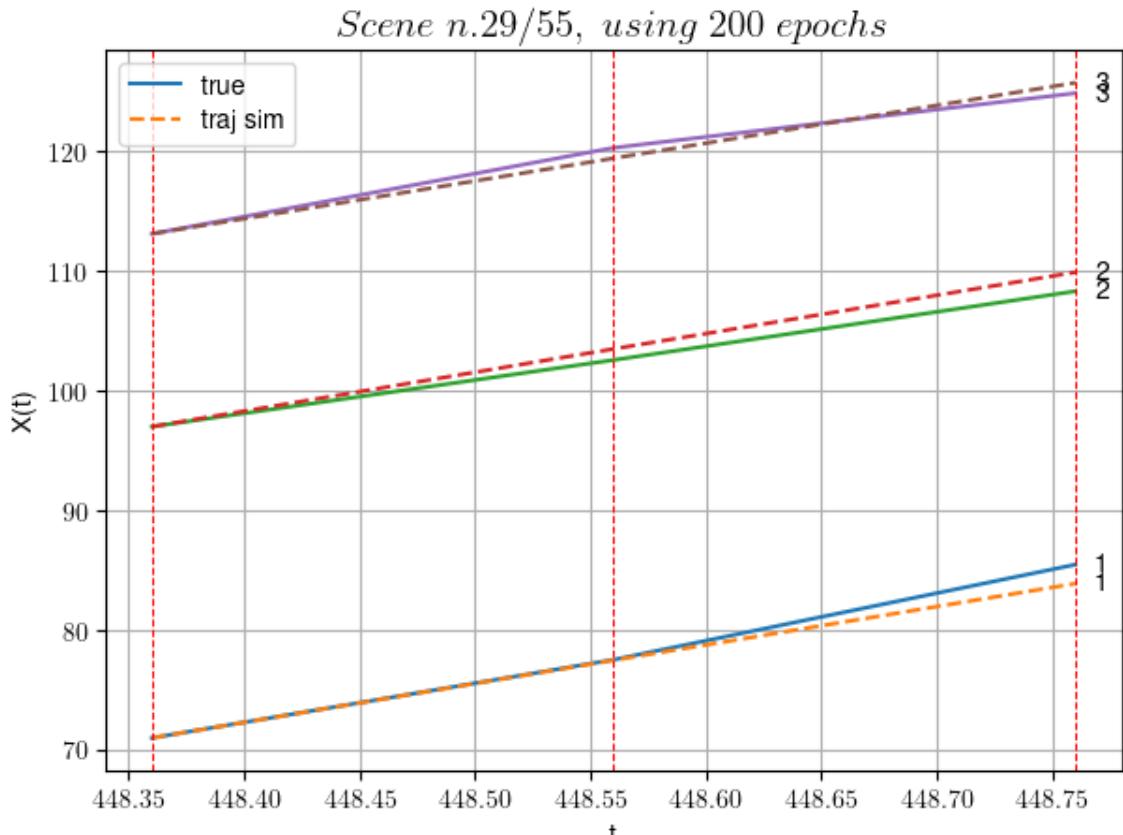
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Scene n.29/55, time interval:[448.36,448.76]

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Loss: 0.8245165678146941  
v0 updated: 31.583307782368443

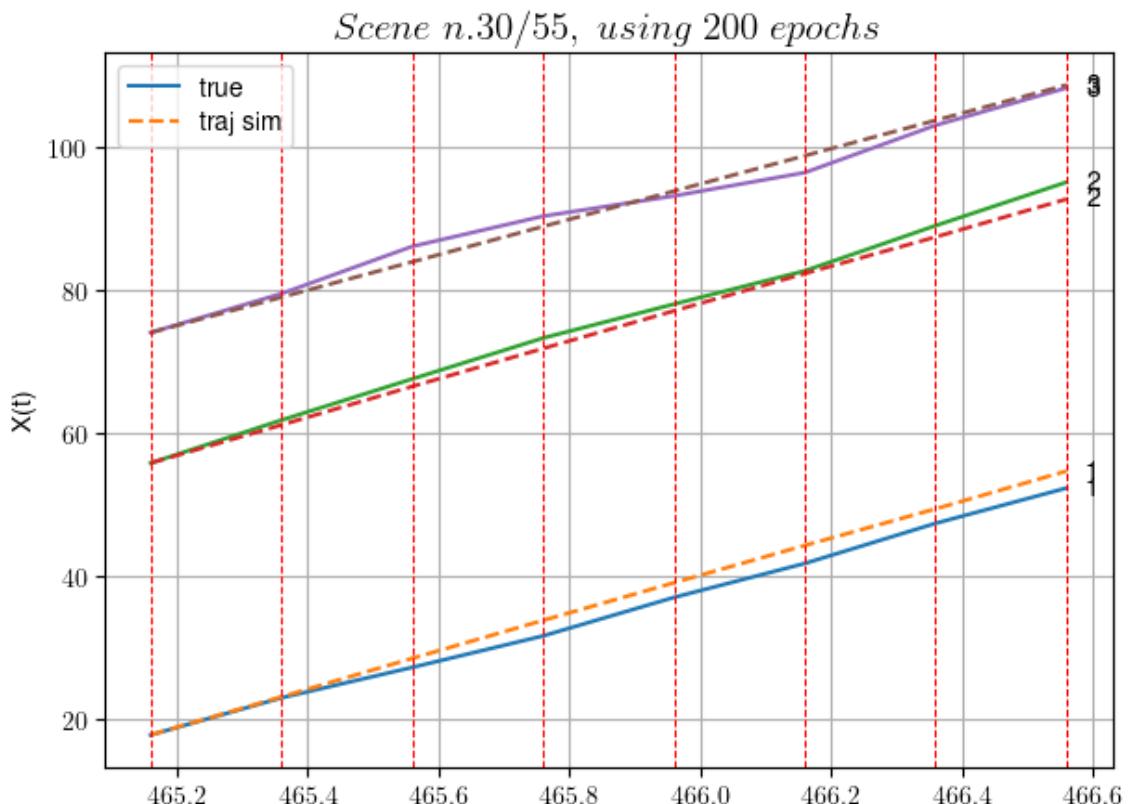
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Scene n.30/55, time interval:[465.16,466.56]

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Loss: 2.213056104503791  
v0 updated: 24.727874292569464

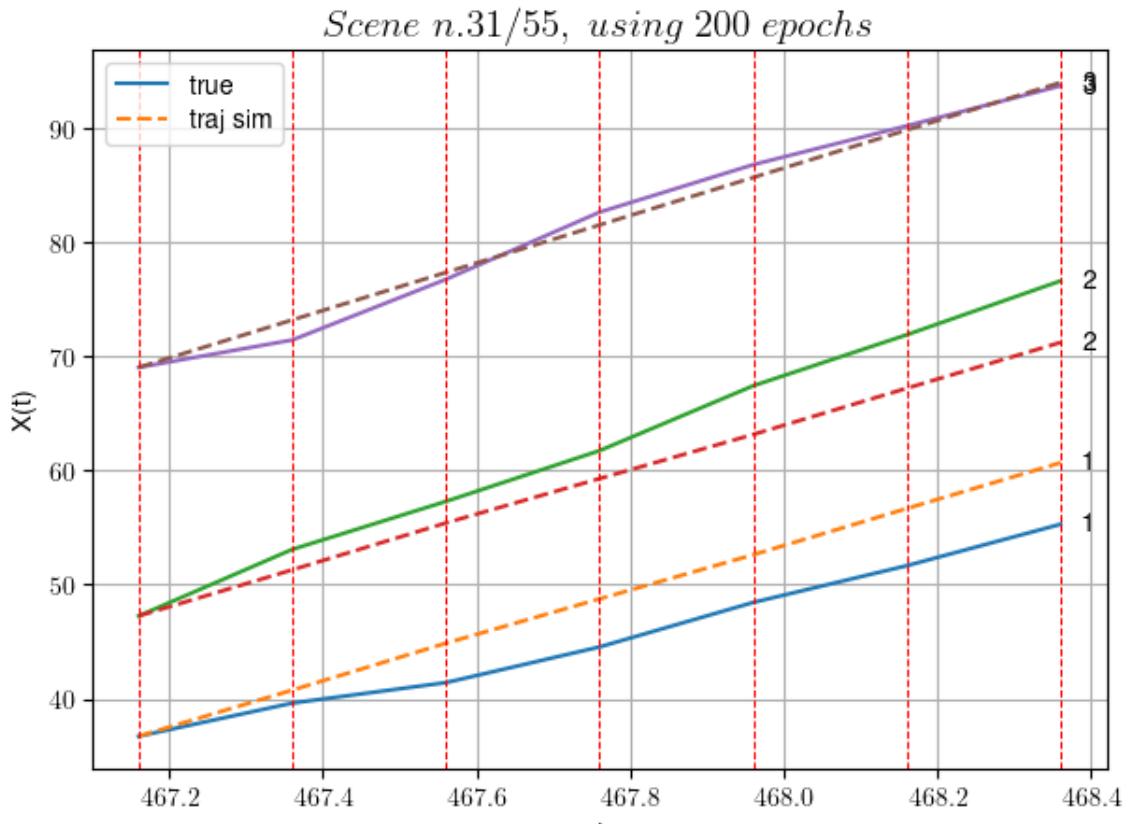
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Scene n.31/55, time interval:[467.16,468.36]

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Loss: 9.069239792360658  
v0 updated: 20.786390638769962

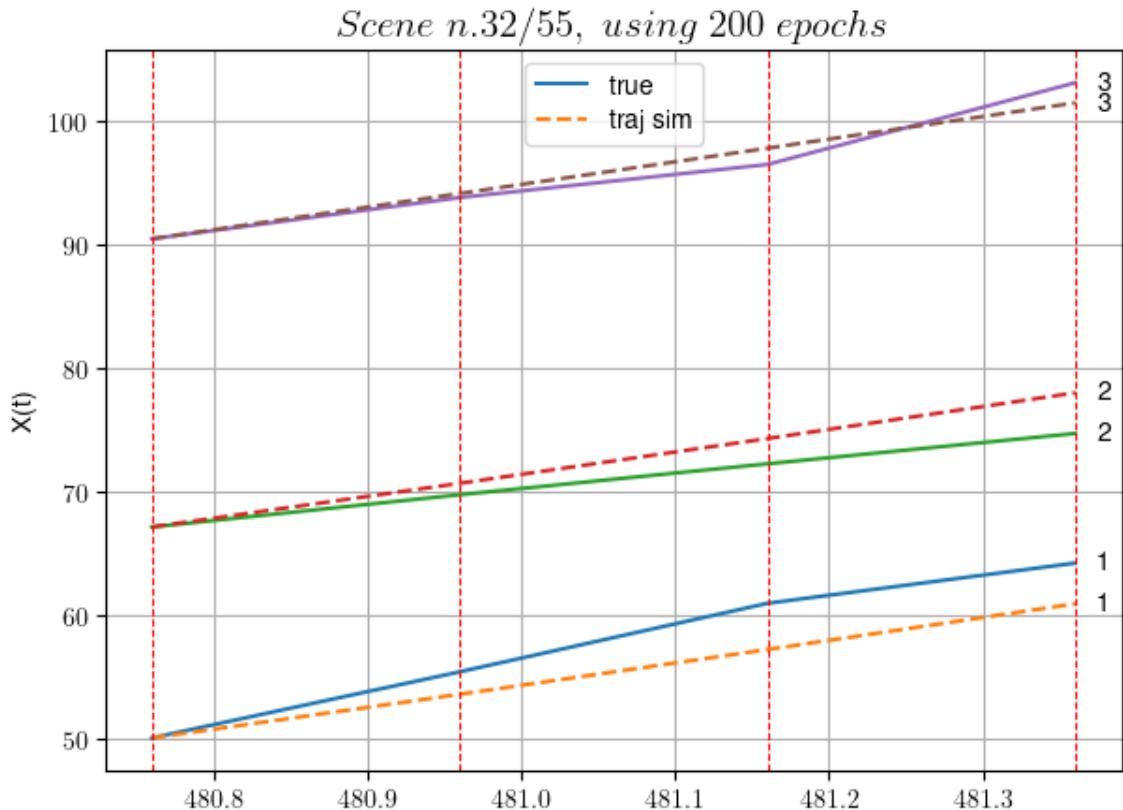
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Scene n.32/55, time interval:[480.76,481.36]

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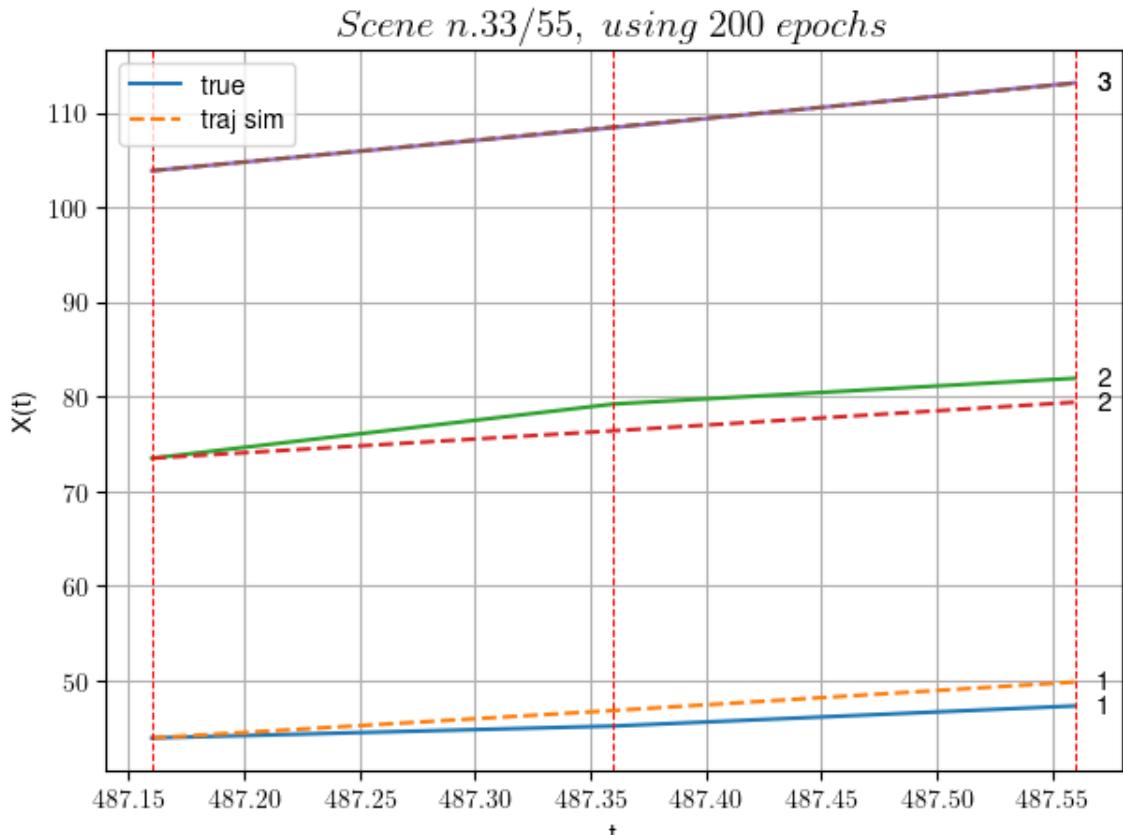


Loss: 4.030519898725794  
v0 updated: 18.31768317689234

---

Scene n.33/55, time interval:[487.16,487.56]

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Loss: 2.6083881345139517  
v0 updated: 23.079438842785727

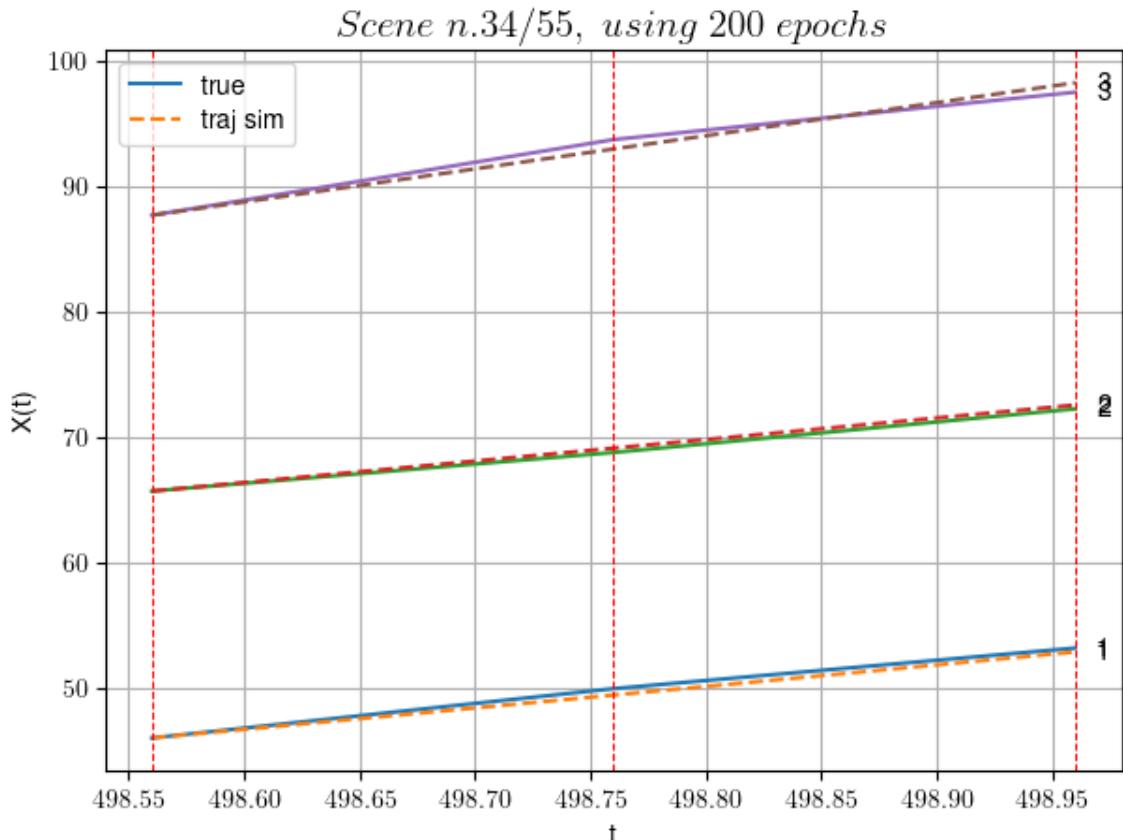
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Scene n.34/55, time interval:[498.56,498.96]

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Loss: 0.18831510634036222  
v0 updated: 26.40821113207029

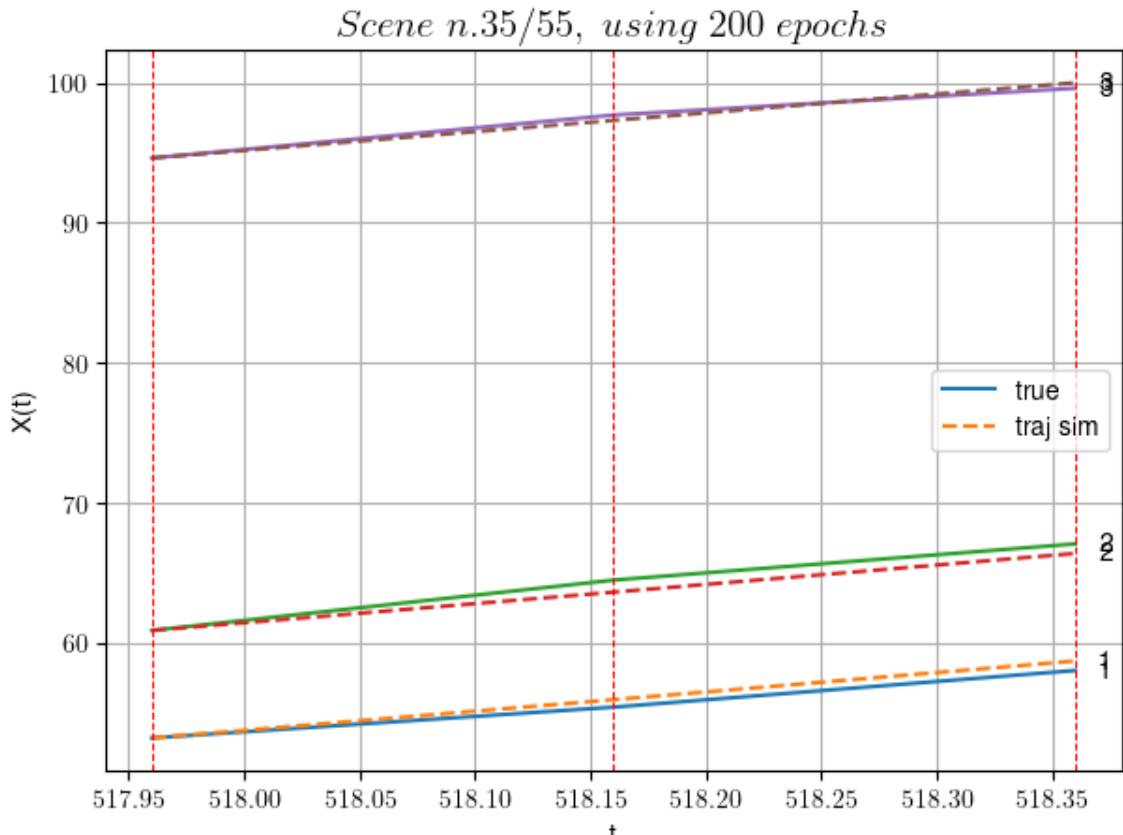
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Scene n.35/55, time interval:[517.96,518.36]

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Loss: 0.2510300759056301  
v0 updated: 13.453926468383587

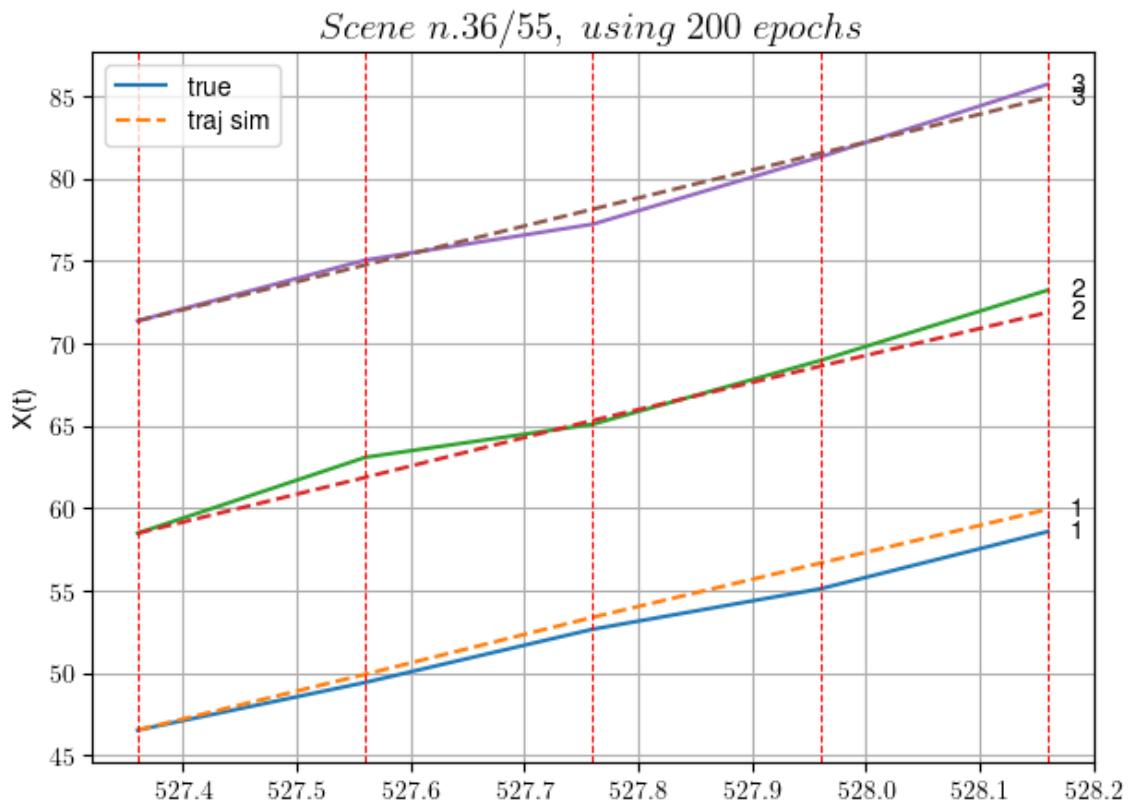
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Scene n.36/55, time interval:[527.36,528.16]

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Loss: 0.6743855766574655  
v0 updated: 16.935267042056086

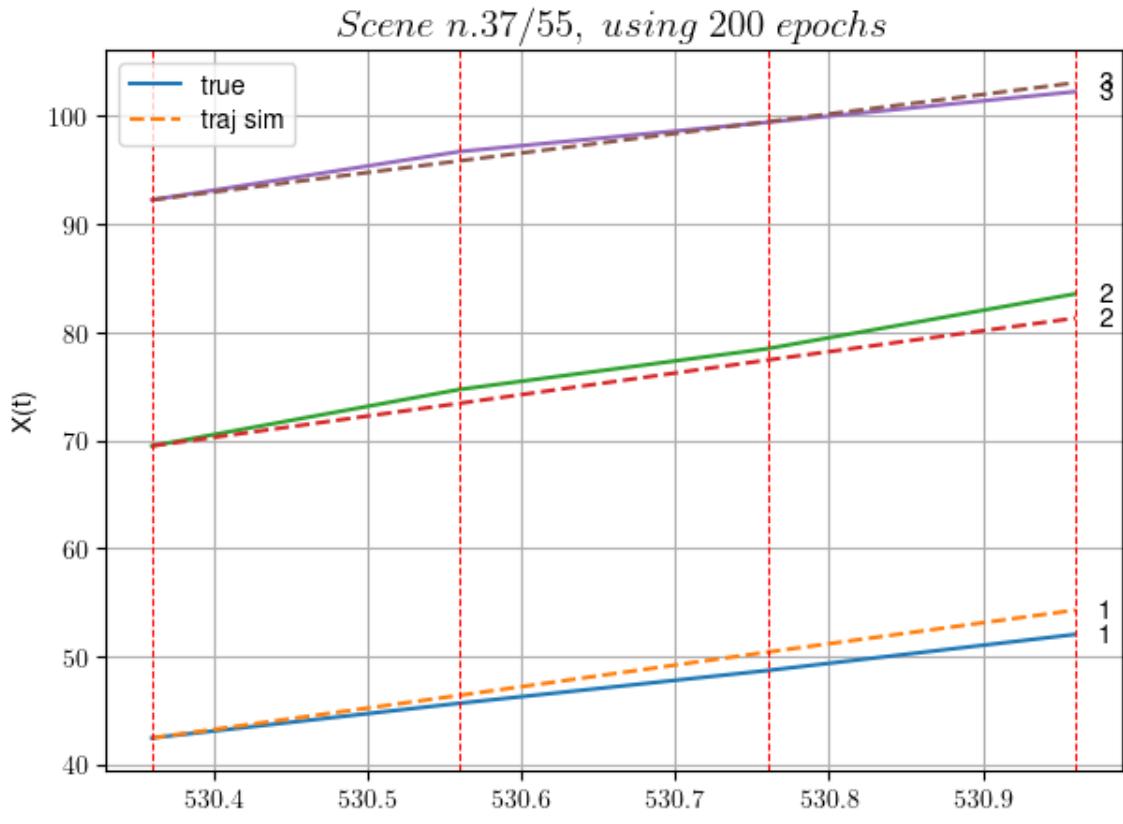
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Scene n.37/55, time interval:[530.36,530.96]

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Loss: 1.4736346805062757  
v0 updated: 18.067971080825455

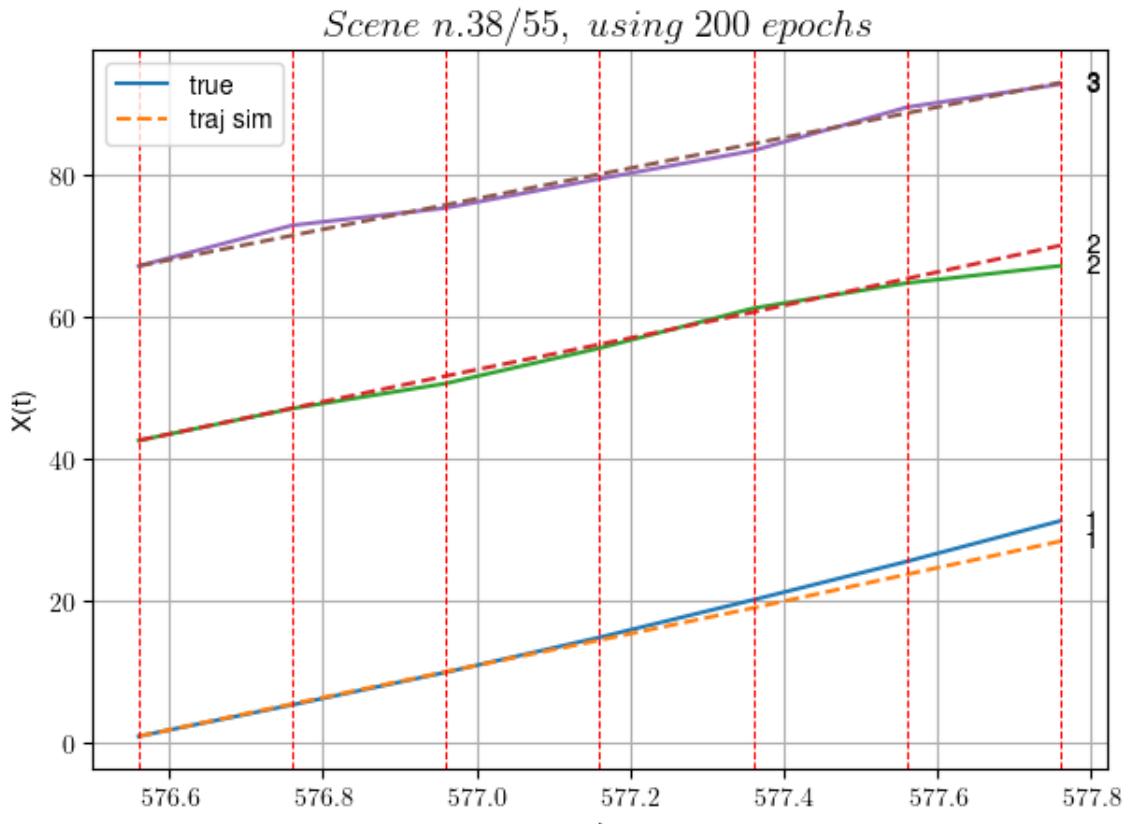
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Scene n.38/55, time interval:[576.56,577.76]

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Loss: 1.31705743883455  
v0 updated: 21.52600293608991

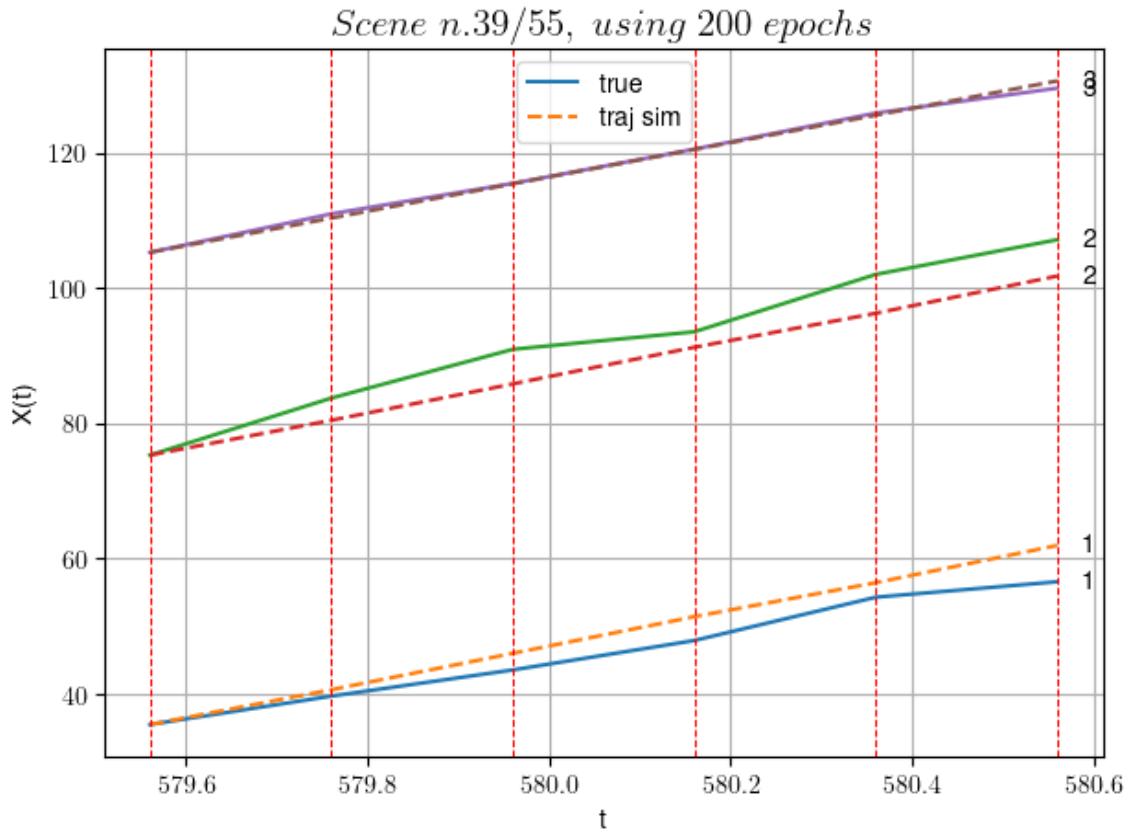
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Scene n.39/55, time interval:[579.56,580.56]

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Loss: 8.804431783625555  
v0 updated: 25.36350099714996

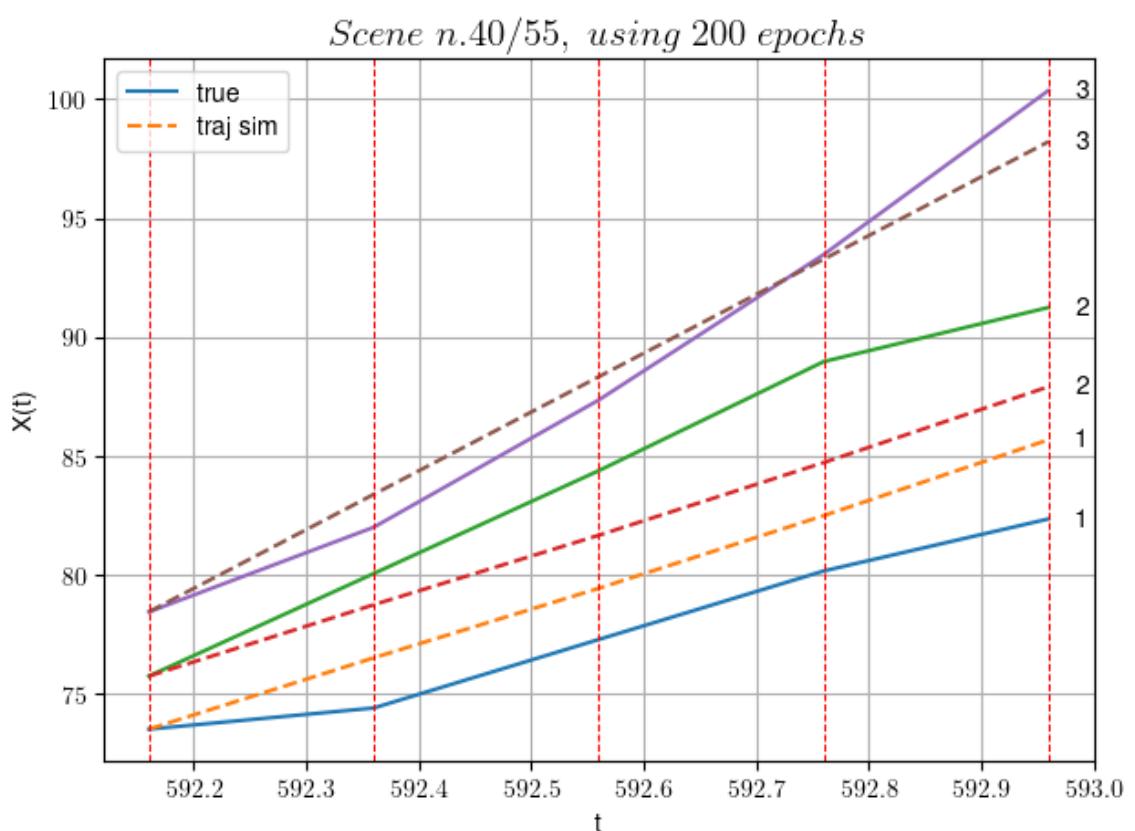
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Scene n.40/55, time interval:[592.16,592.96]

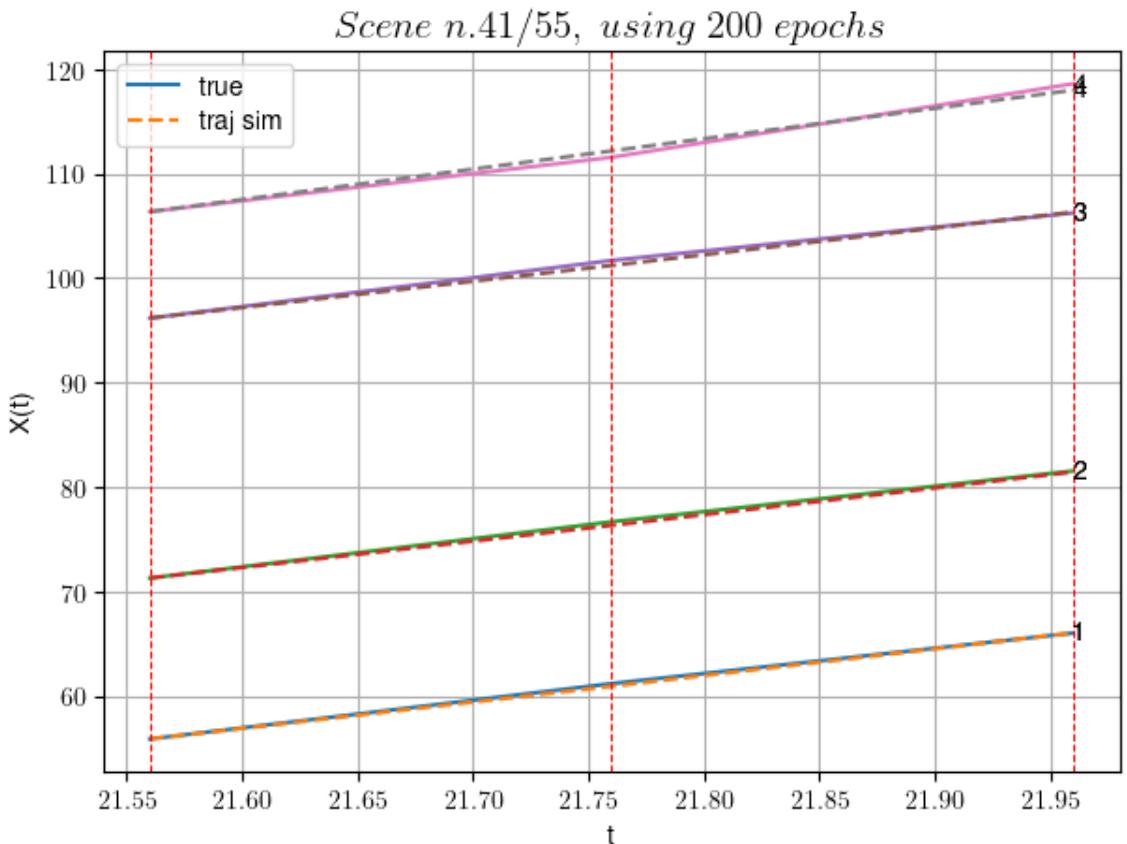
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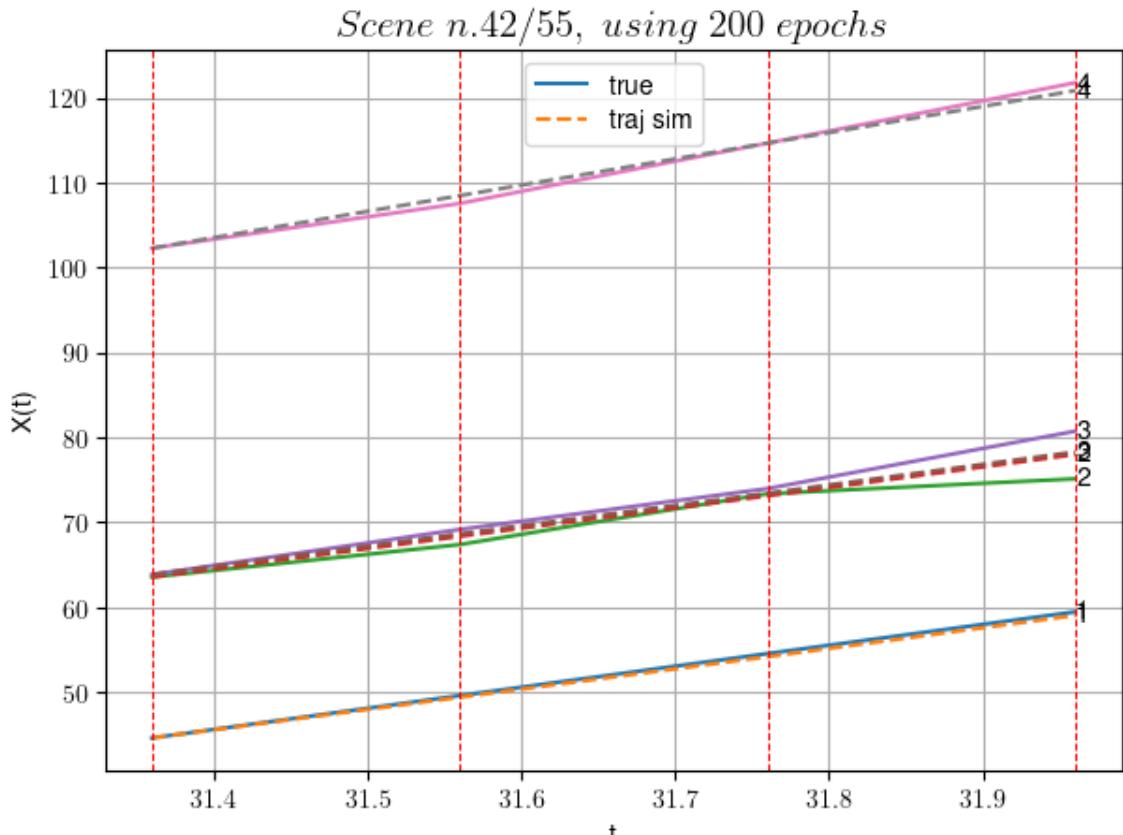
Loss: 4.7550046660533445  
v0 updated: 24.715789260210165

Scene n.41/55, time interval:[21.56,21.96]



Loss: 0.09877804499328294  
v0 updated: 29.08930460717769

Scene n.42/55, time interval:[31.36,31.96]

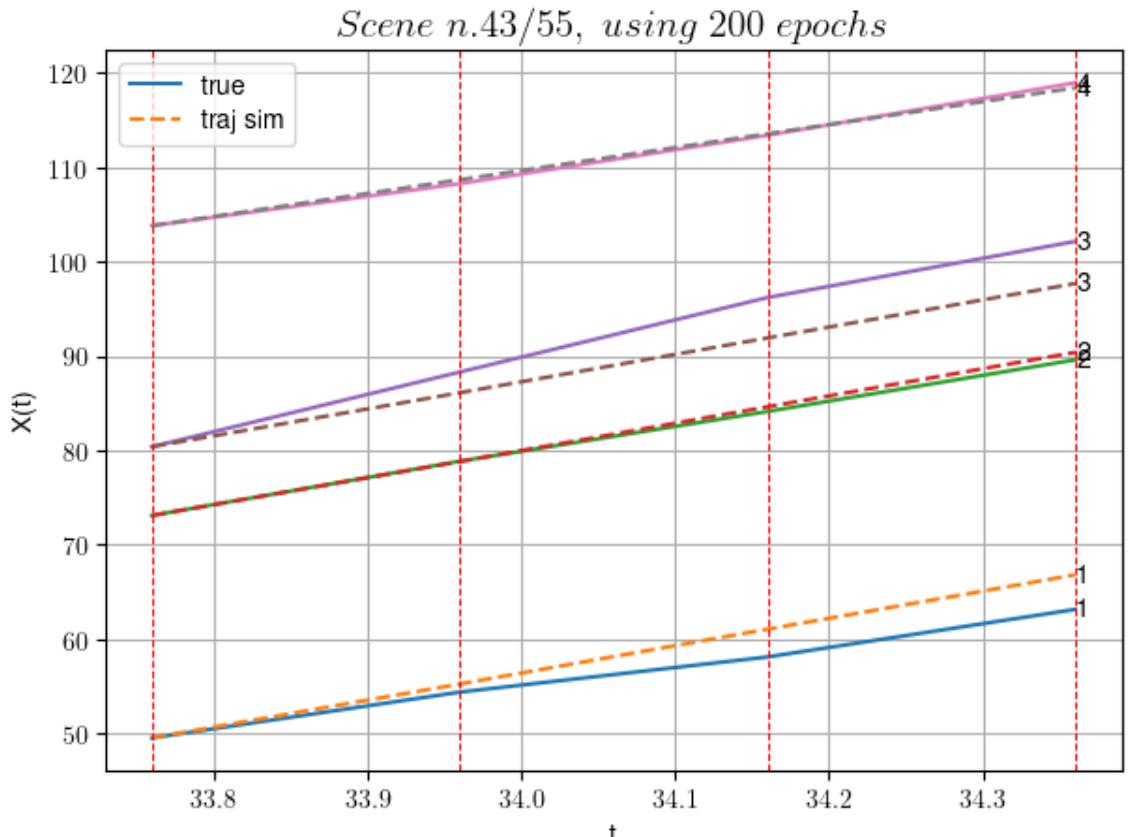


Loss: 1.1128169255490785  
v0 updated: 30.911522722567675

---

Scene n.43/55, time interval:[33.76,34.36]

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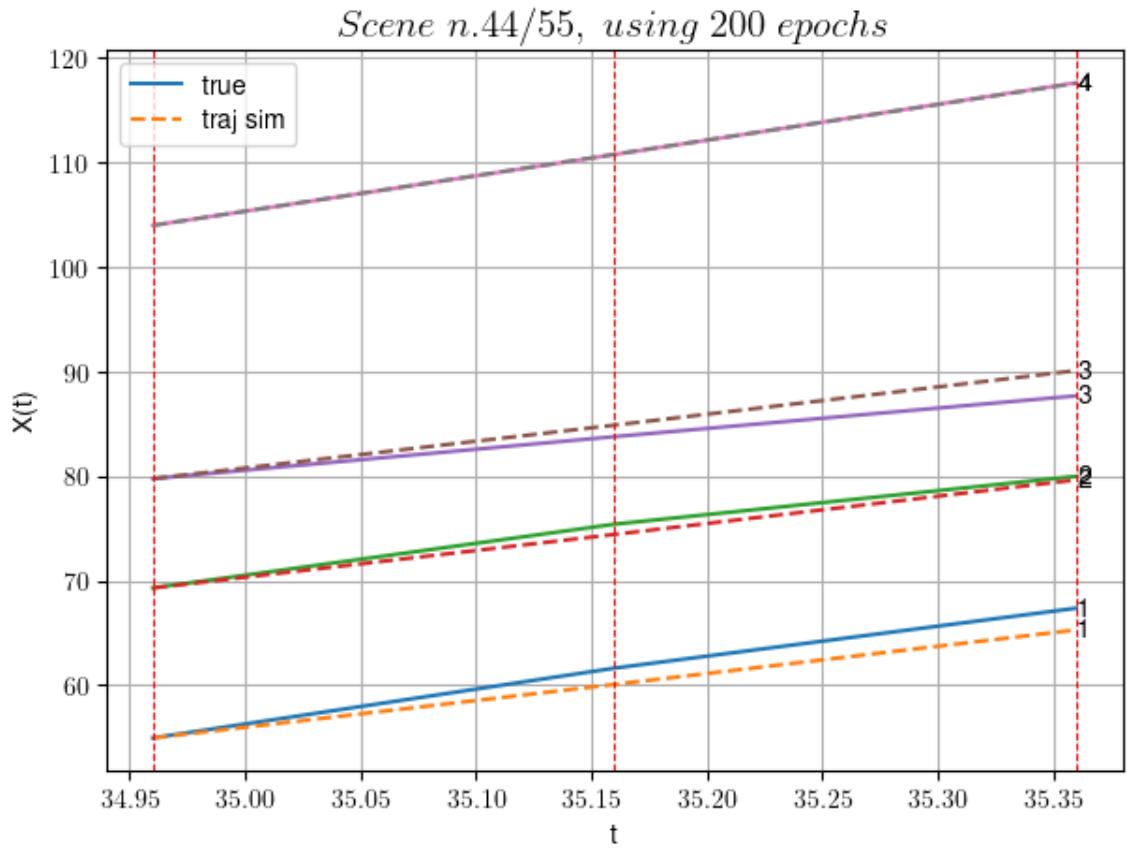


Loss: 4.203071994227673  
v0 updated: 24.350672666072207

---

Scene n.44/55, time interval:[34.96,35.36]

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Loss: 1.2378703185576205  
v0 updated: 34.01960344941417

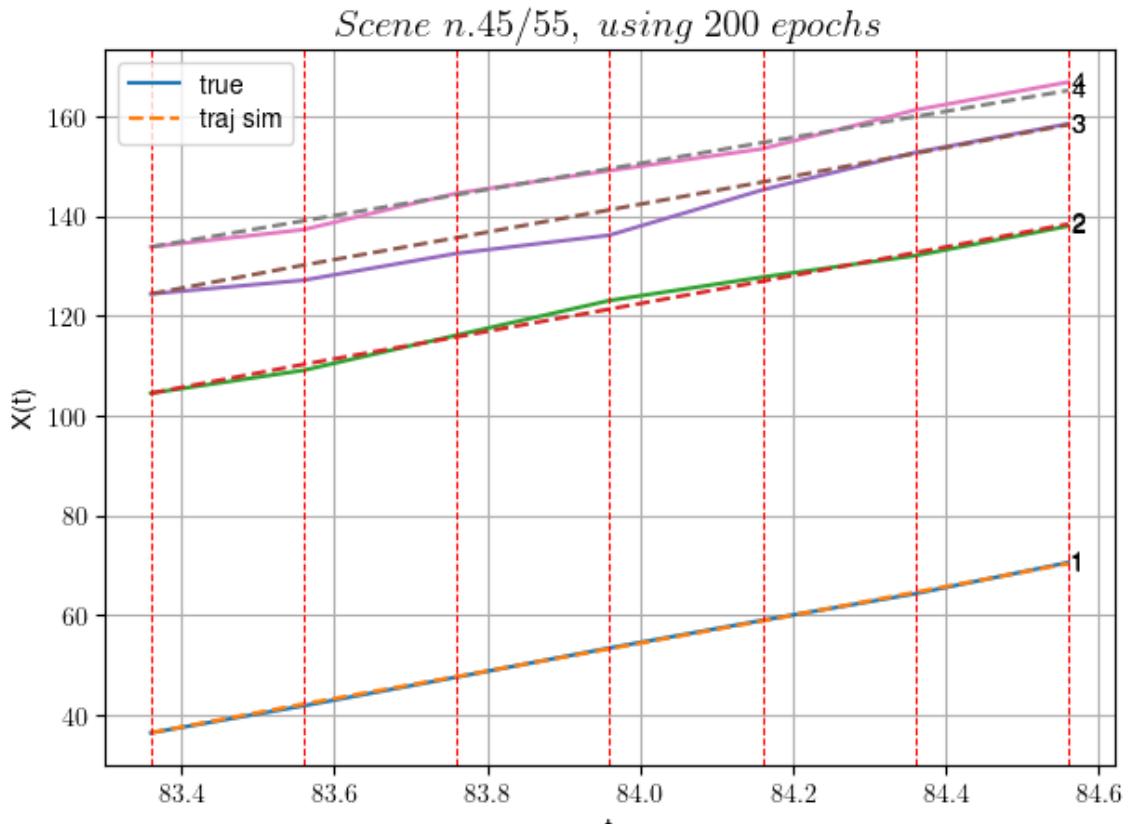
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Scene n.45/55, time interval:[83.36,84.56]

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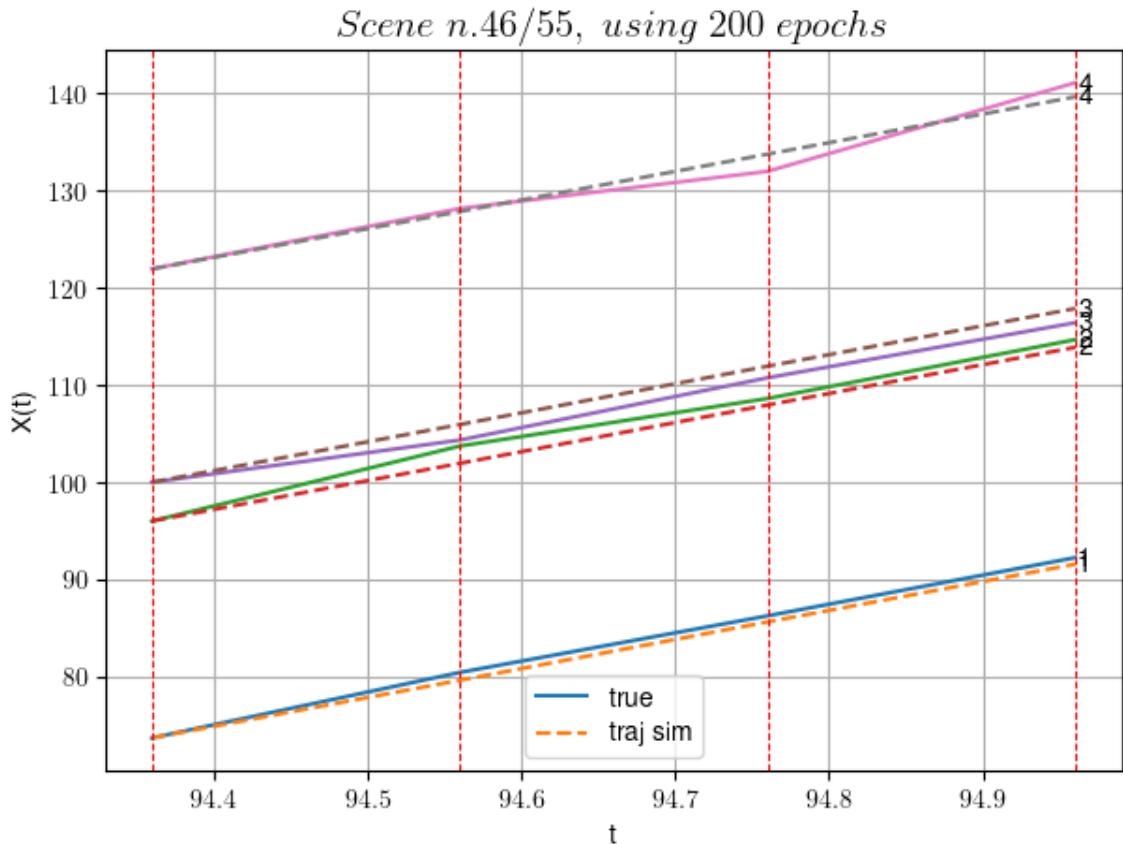


Loss: 2.249874666033817  
v0 updated: 26.131707170269824

---

Scene n.46/55, time interval:[94.36,94.96]

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Loss: 1.0726312609968136  
v0 updated: 29.52907574185669

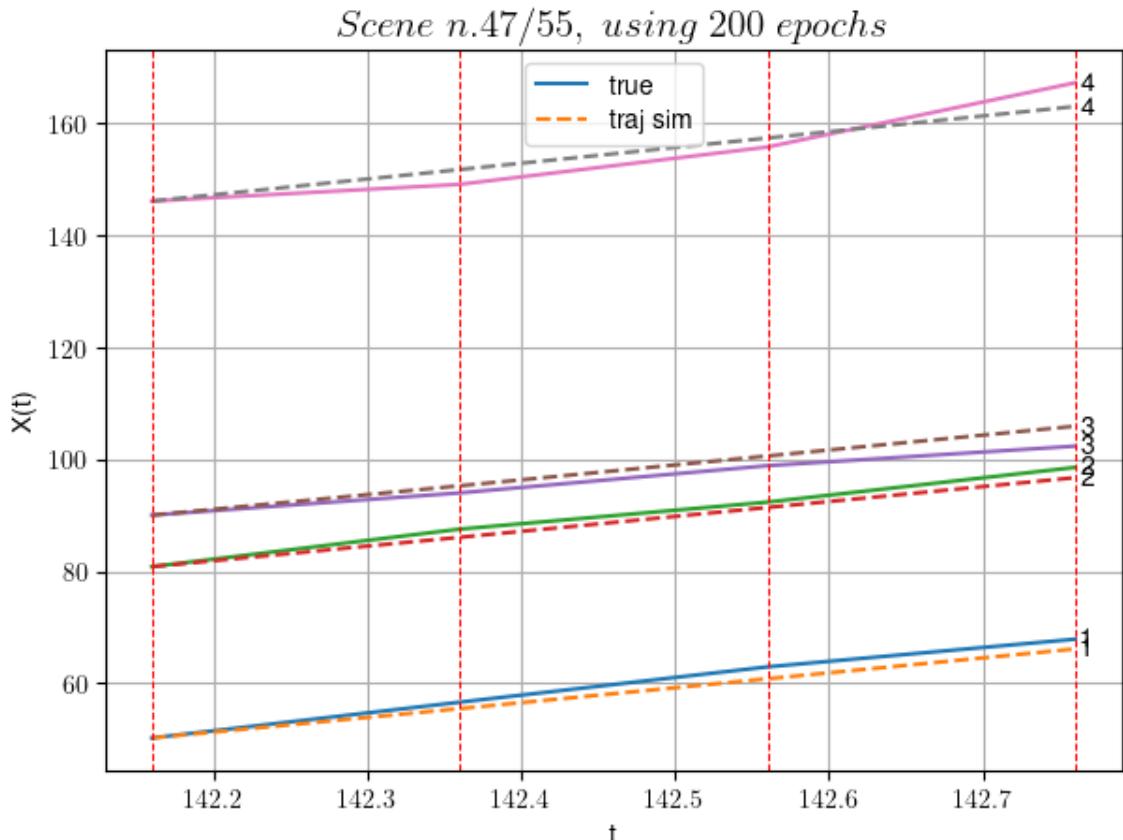
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Scene n.47/55, time interval:[142.16,142.76]

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Loss: 3.753000128471376  
v0 updated: 28.13281408756362

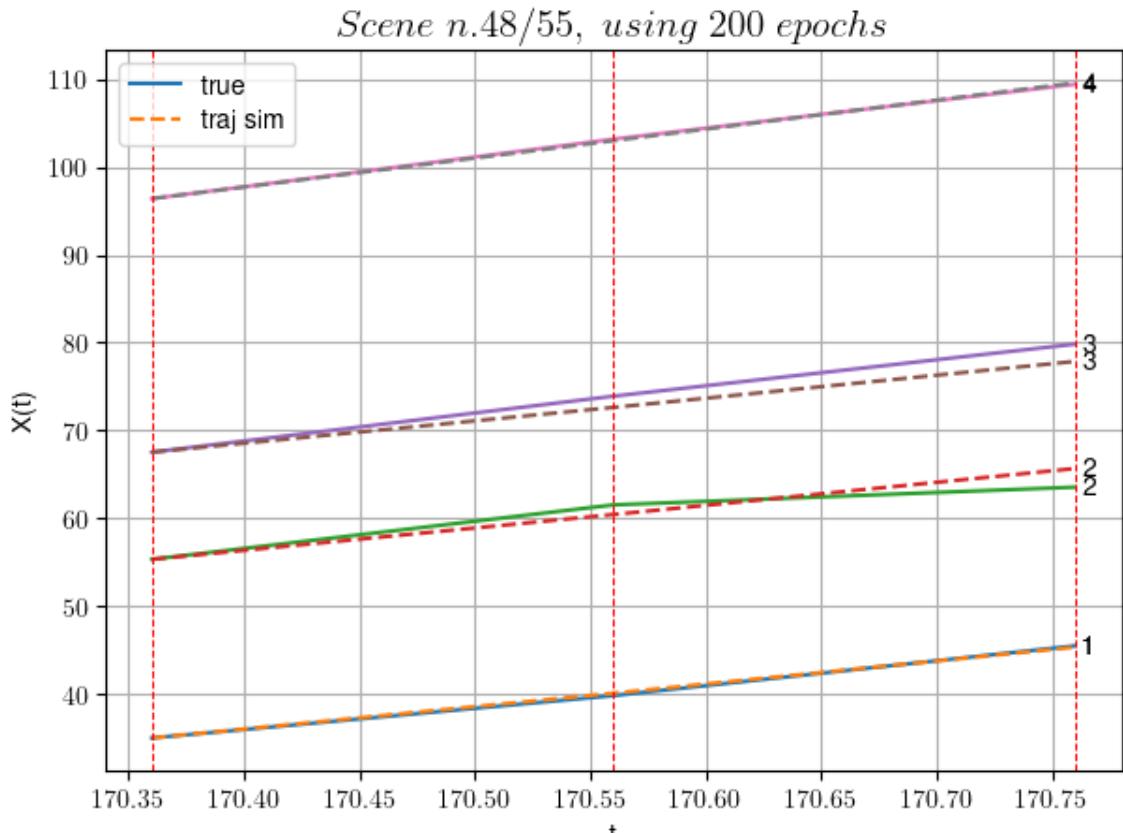
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Scene n.48/55, time interval:[170.36,170.76]

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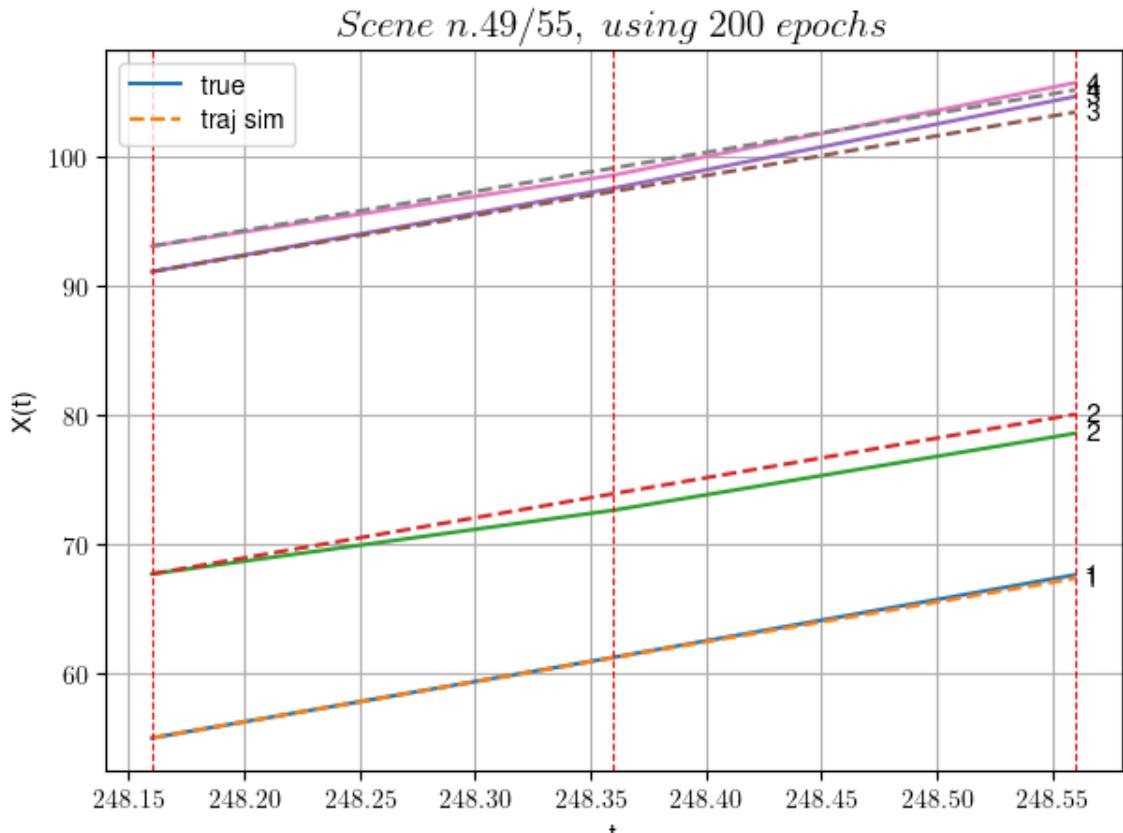


Loss: 0.946580330466954  
v0 updated: 32.978076203930534

---

Scene n.49/55, time interval:[248.16,248.56]

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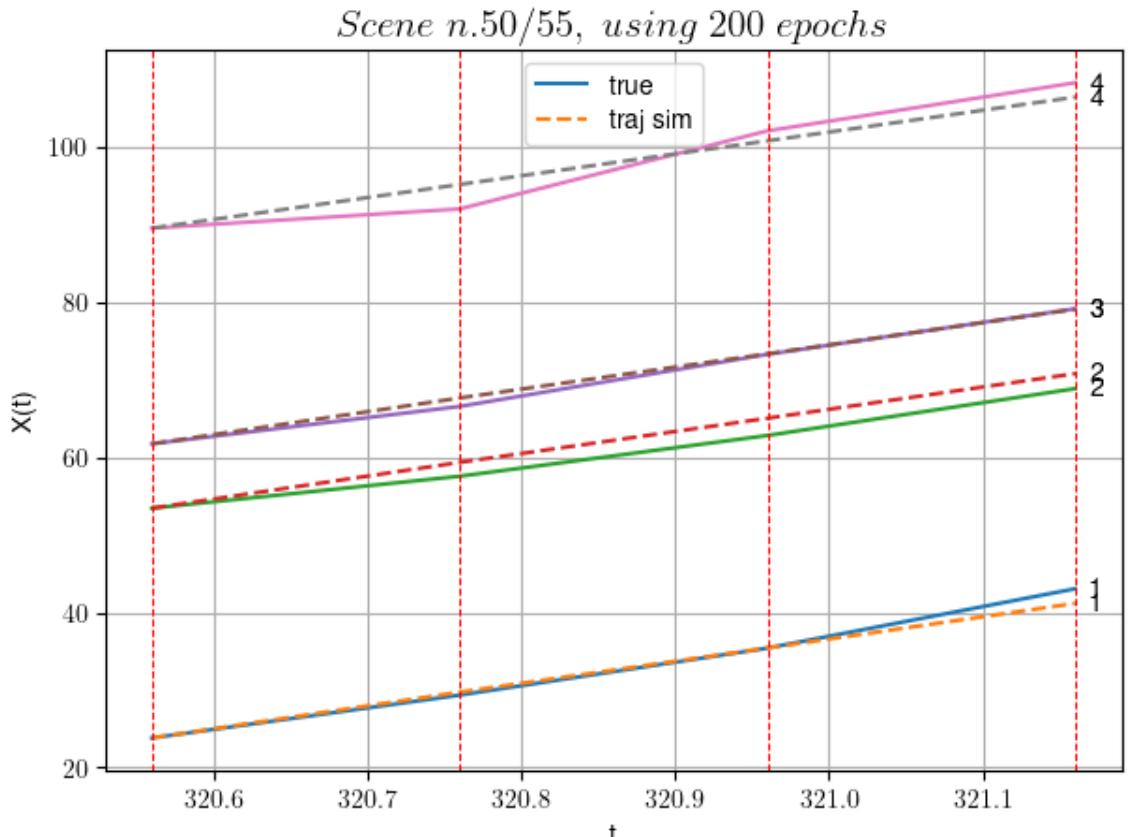


Loss: 0.5004548396221593  
v0 updated: 30.24743653164149

---

Scene n.50/55, time interval:[320.56,321.16]

---



Loss: 1.9843200432195982  
v0 updated: 28.141662429457412

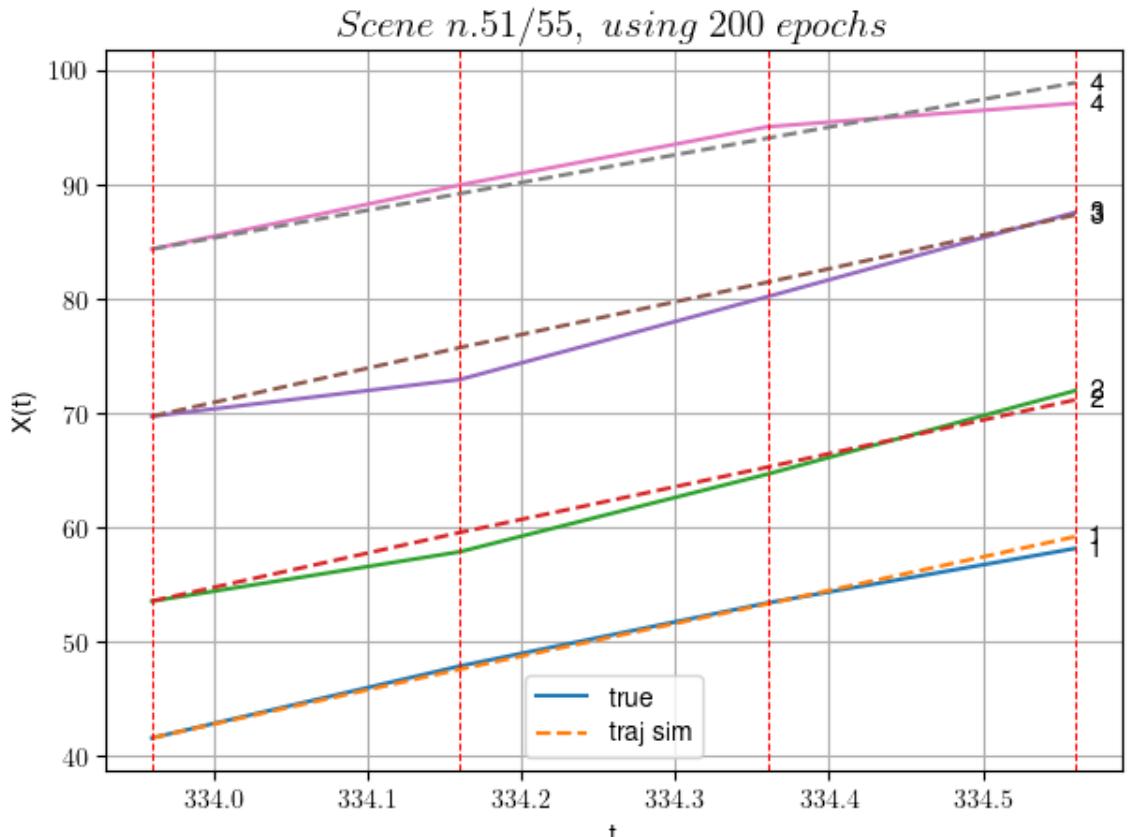
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Scene n.51/55, time interval:[333.96,334.56]

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Loss: 1.2044664304797075  
v0 updated: 24.25439744624117

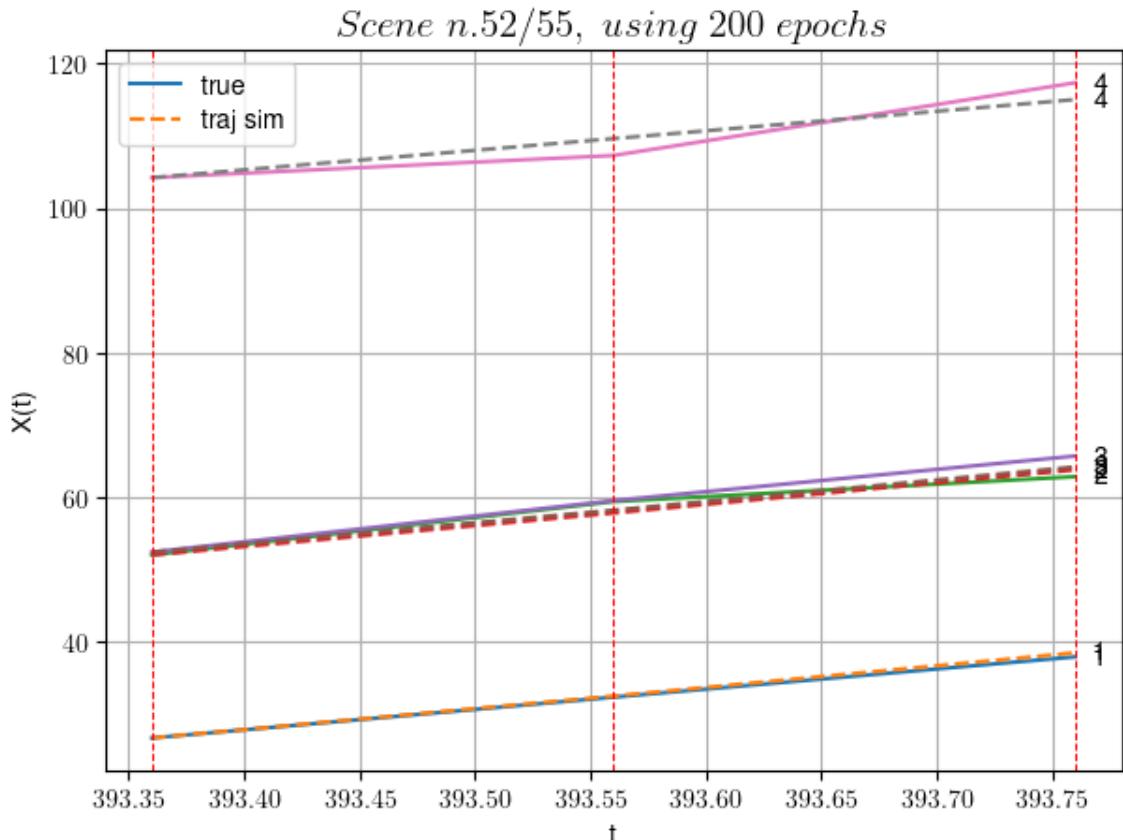
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Scene n.52/55, time interval:[393.36,393.76]

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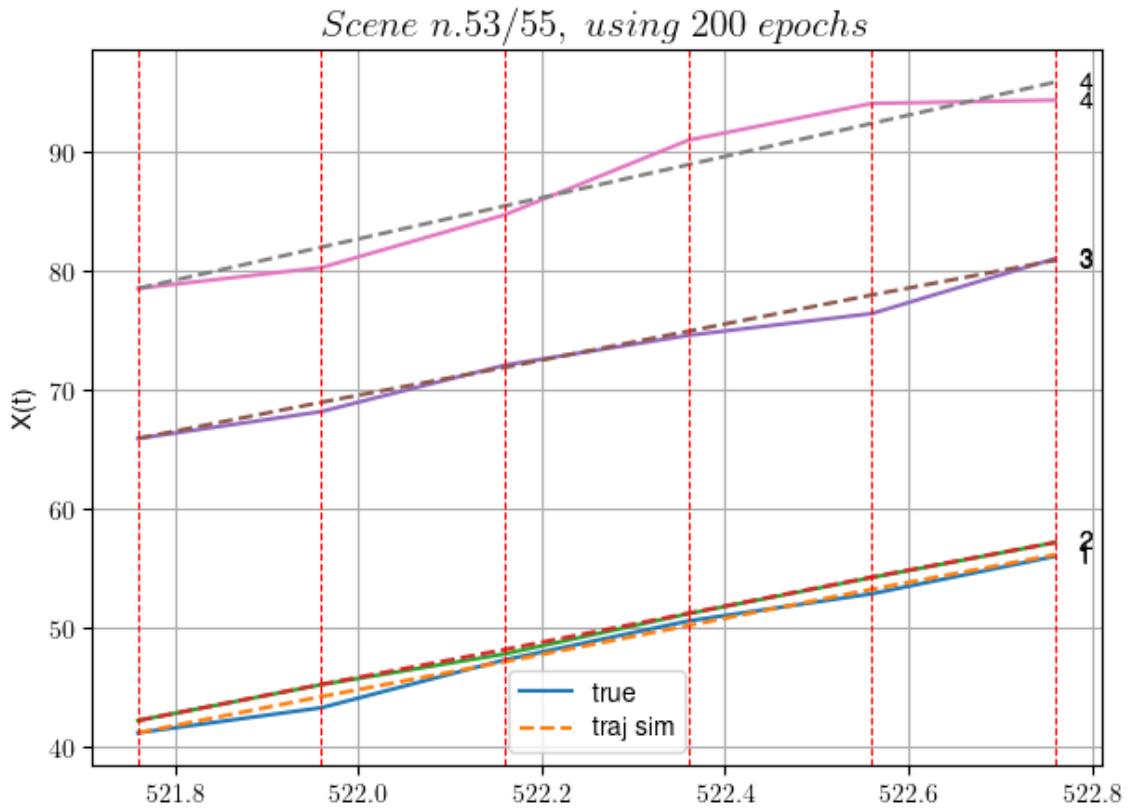


Loss: 1.5557799039884679  
v0 updated: 27.024739809167087

---

Scene n.53/55, time interval:[521.76,522.76]

---



Loss: 0.7236773981377906  
v0 updated: 17.326362767839466

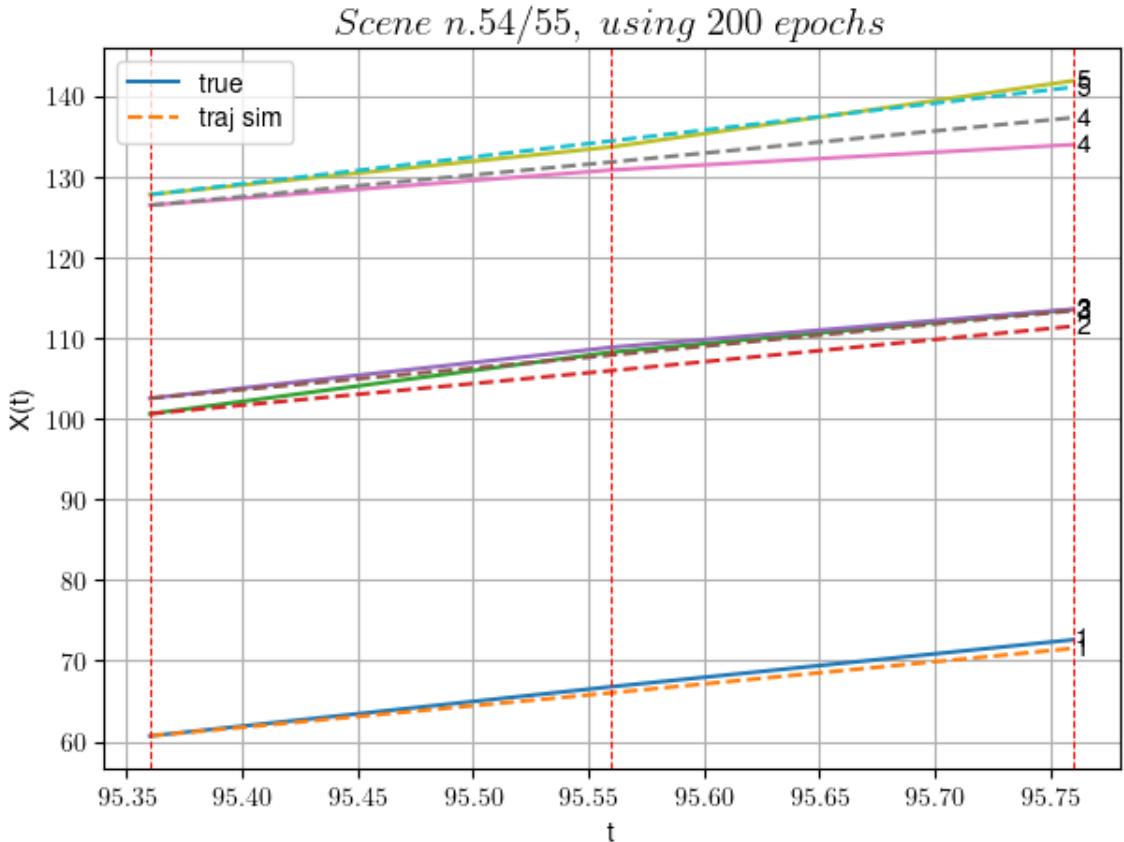
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Scene n.54/55, time interval:[95.36,95.76]

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Loss: 1.7090973752768135  
 $v_0$  updated: 33.29374725104849

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$v_0$ \_mean in this df is: 28.553527636062555  
Time taken: 317.34s  
Hidden-Layer-1/kernel:0: [-1543128.6 -2946.929]  
Hidden-Layer-1/bias:0: [-76481.914 -237.7462]  
Output-Layer/kernel:0: [-1.2088498e+06 -3.2554160e+02]  
Output-Layer/bias:0: [26.753757]

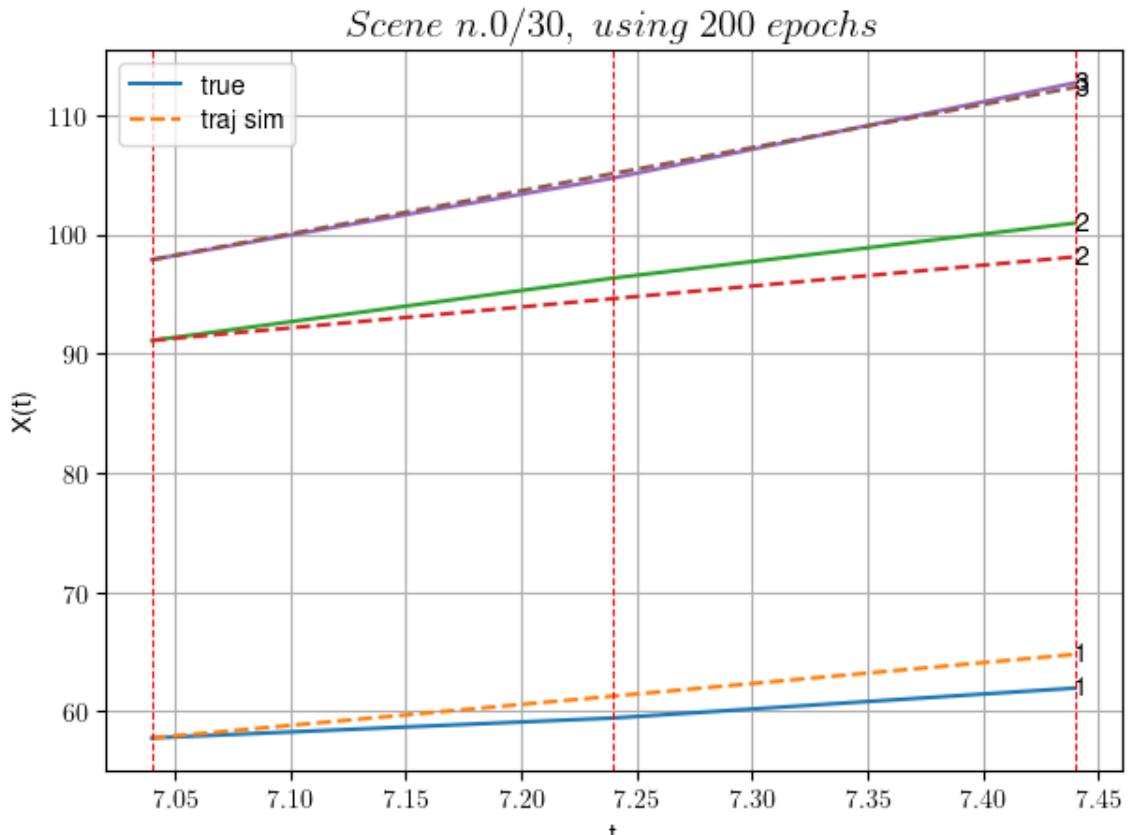
---

In df n.4/10 we have 30 scenes

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Scene n.0/30, time interval:[7.04, 7.44]

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Loss: 2.51731066638844  
v0 updated: 36.147472929252125

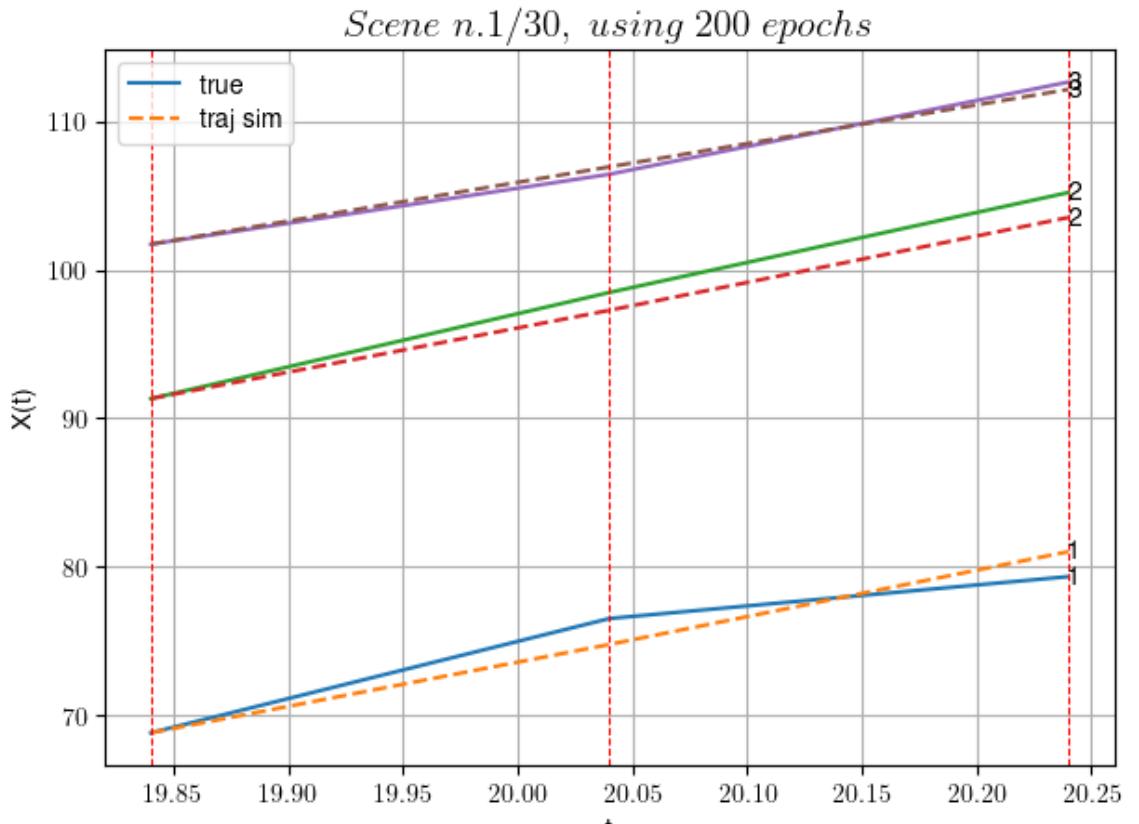
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Scene n.1/30, time interval:[19.84,20.24]

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Loss: 1.1812223205455992  
v0 updated: 26.06329397762493

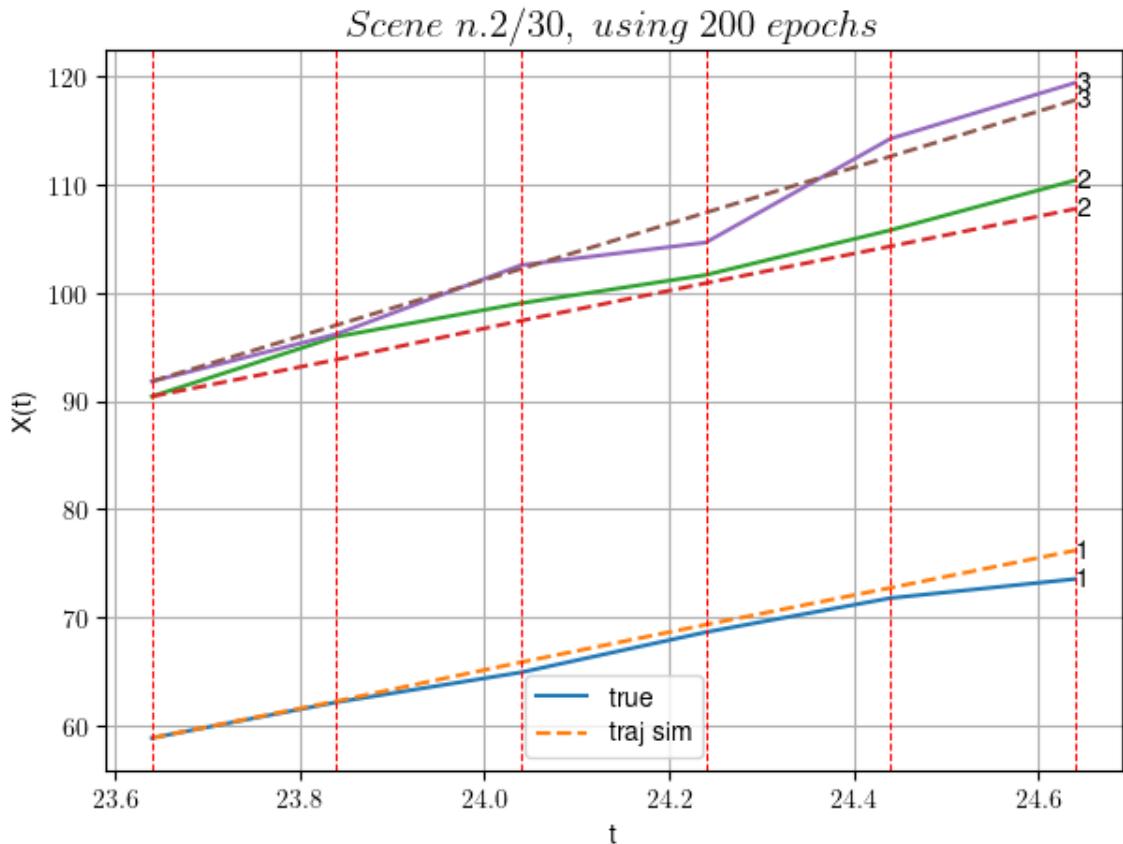
---

---

Scene n.2/30, time interval:[23.64,24.64]

---

---



Loss: 2.2089208809596097  
v0 updated: 25.97899552903699

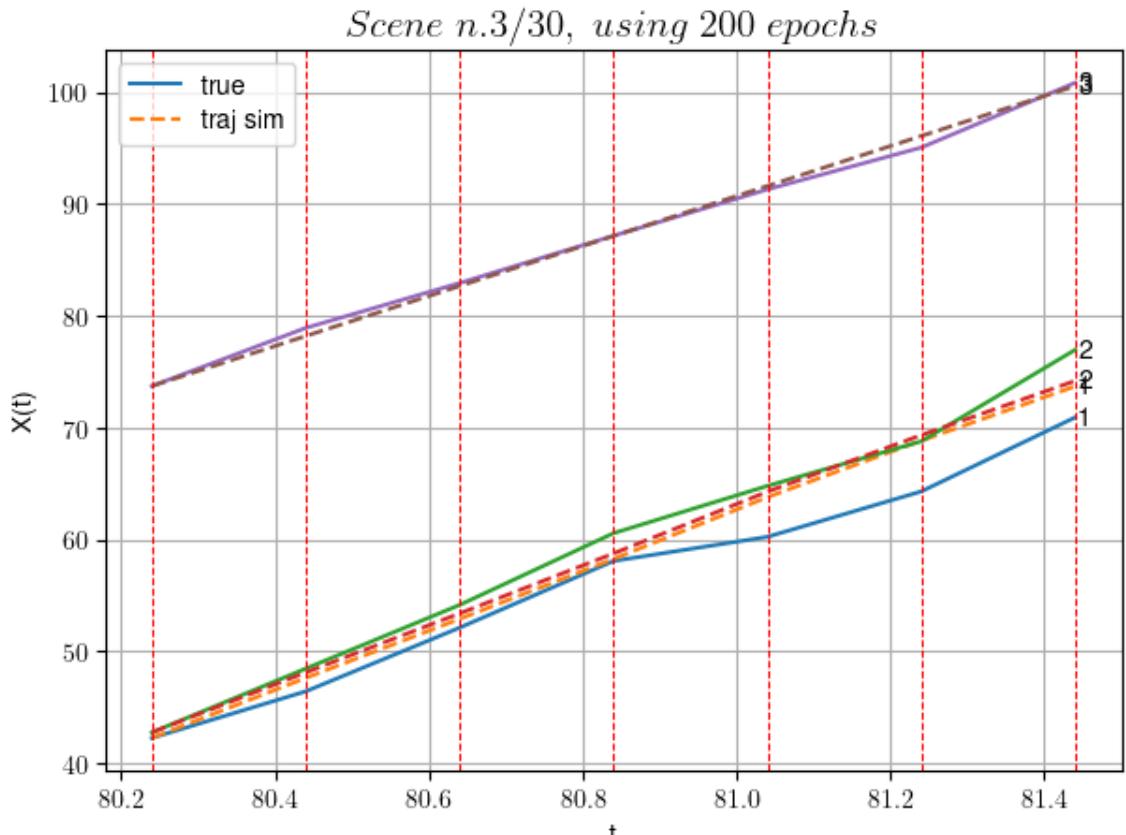
---

---

Scene n.3/30, time interval:[80.24,81.44]

---

---



Loss: 2.7241433448540024  
v0 updated: 22.37615455931493

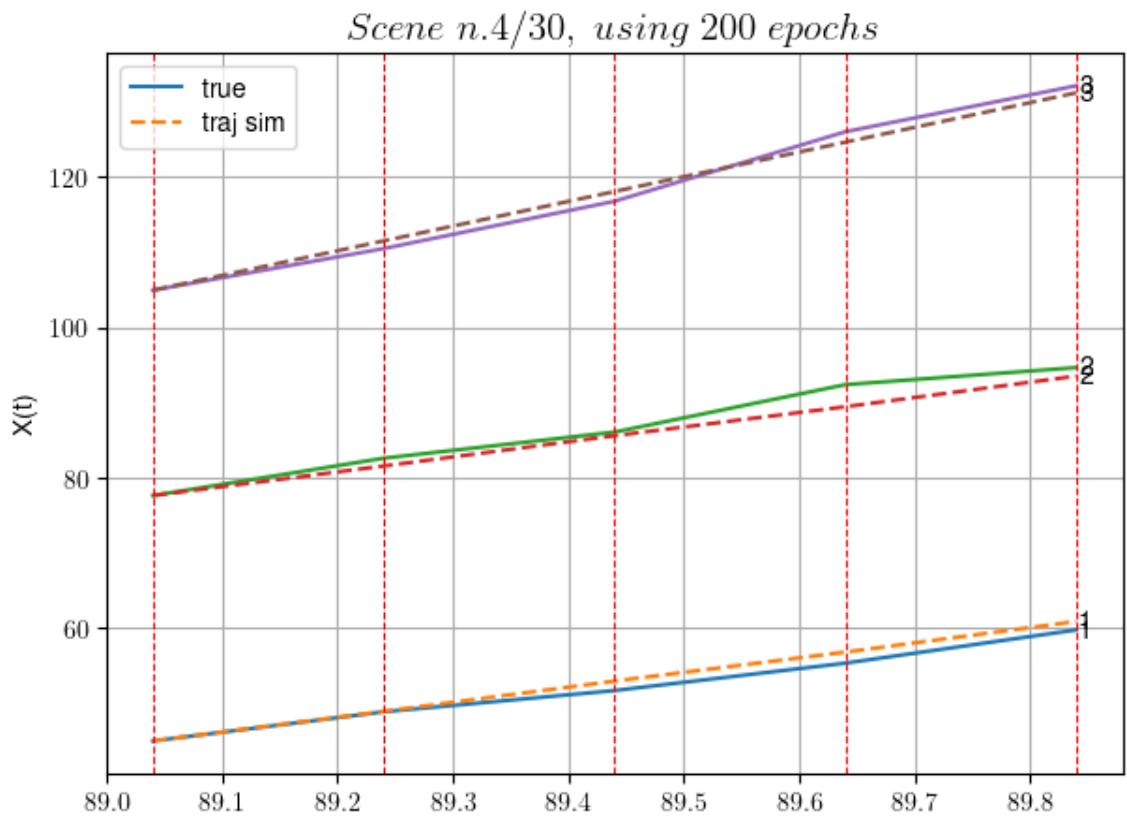
---

---

Scene n.4/30, time interval:[89.04,89.84]

---

---



Loss: 1.4451992409952048  
v0 updated: 32.77238417172515

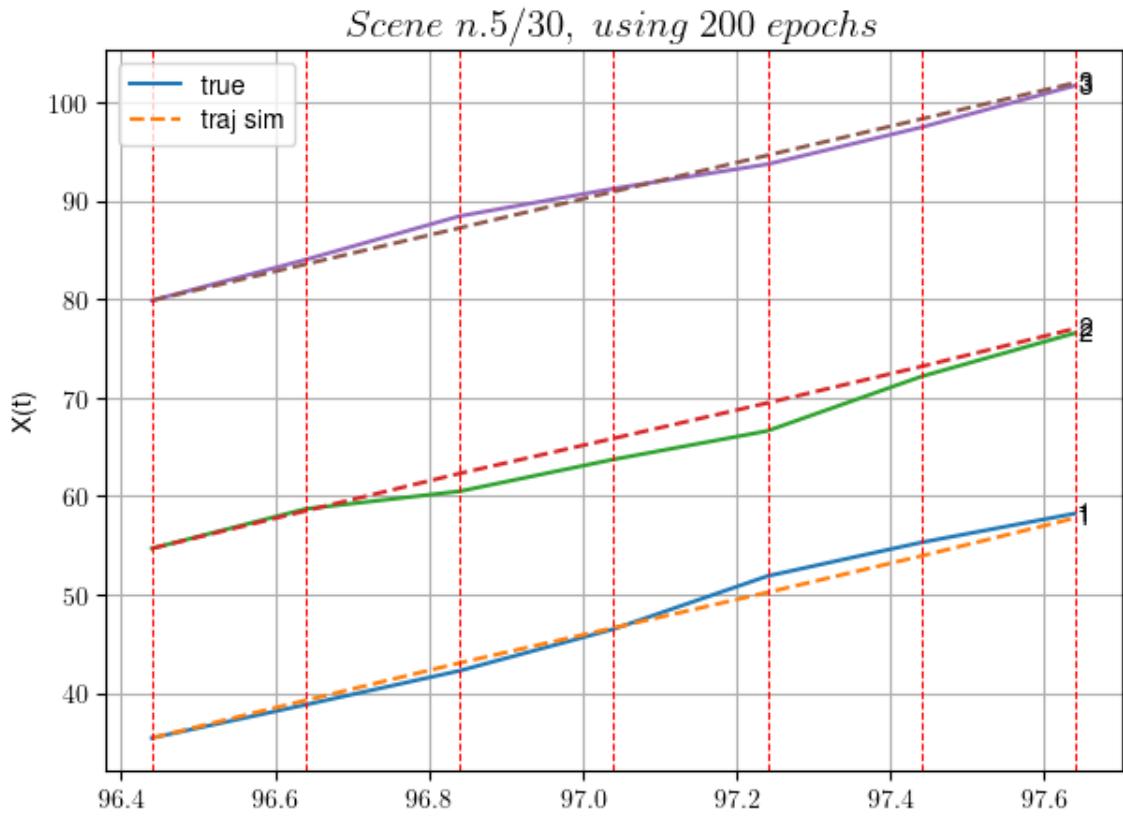
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---

Scene n.5/30, time interval:[96.44,97.64]

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---

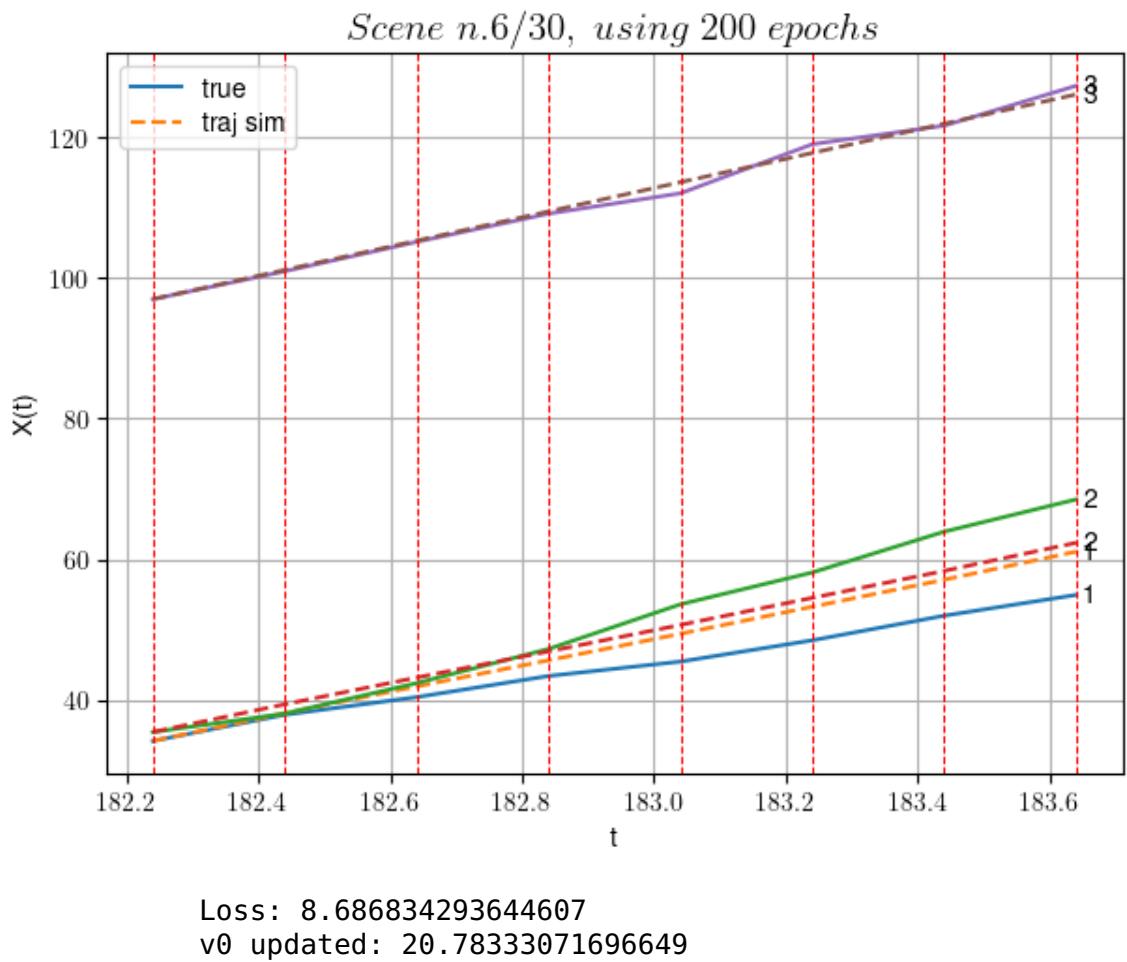


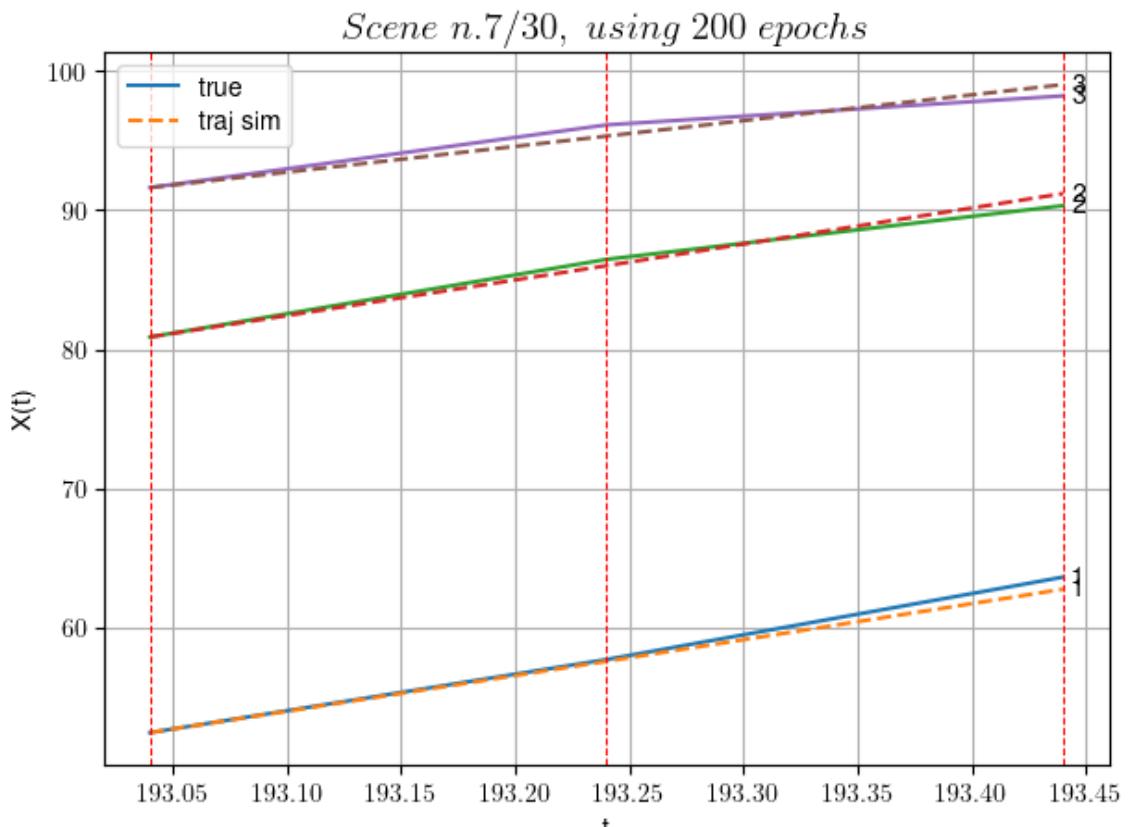
Loss: 1.2476979579362057  
v0 updated: 18.41401615430983

---

Scene n.6/30, time interval:[182.24,183.64]

---





Loss: 0.3385878927494493  
v0 updated: 18.519148732885238

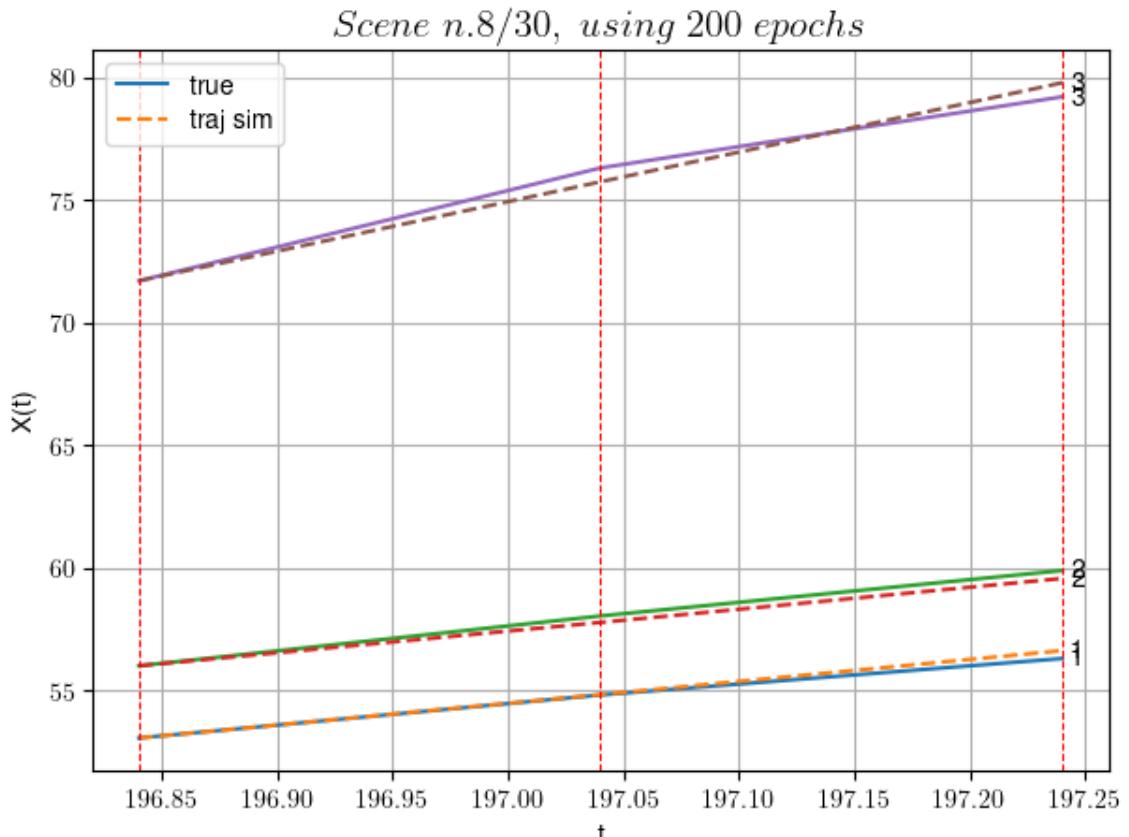
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---

Scene n.8/30, time interval:[196.84,197.24]

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---



Loss: 0.10307610701439758  
v0 updated: 20.19954608763423

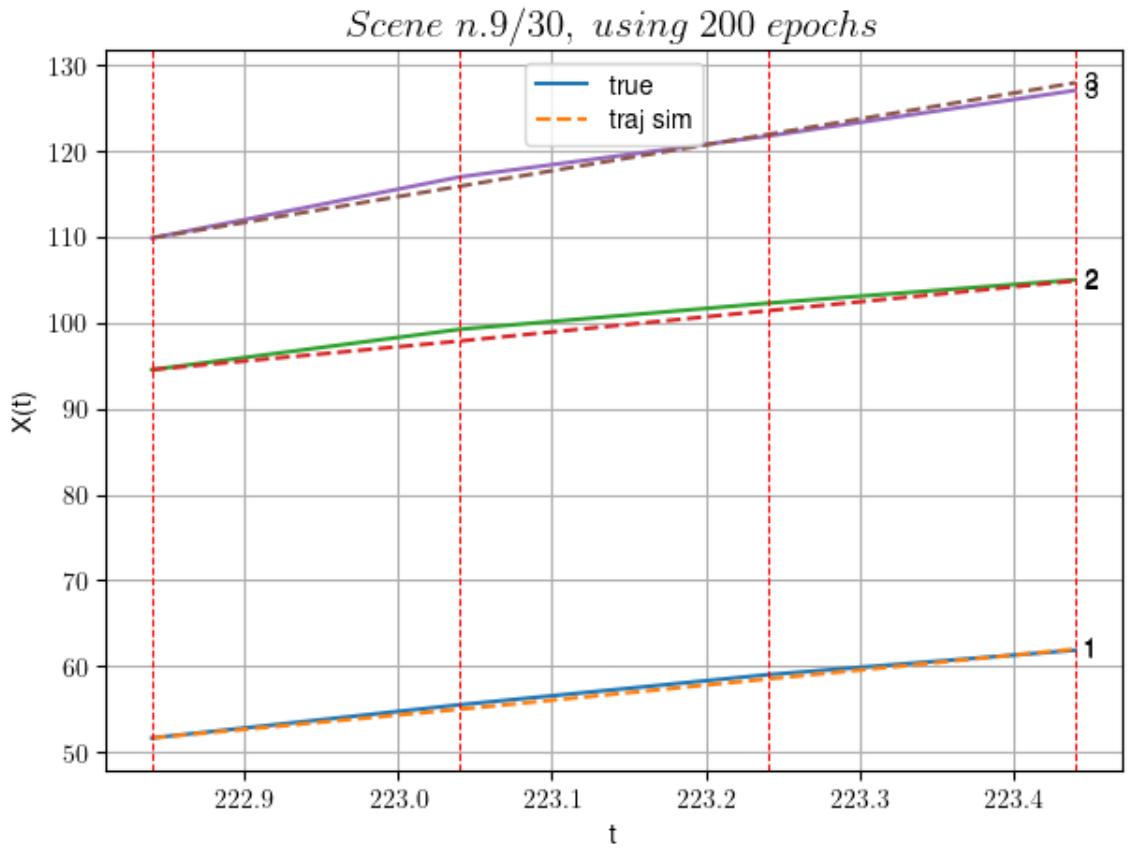
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---

Scene n.9/30, time interval:[222.84,223.44]

---

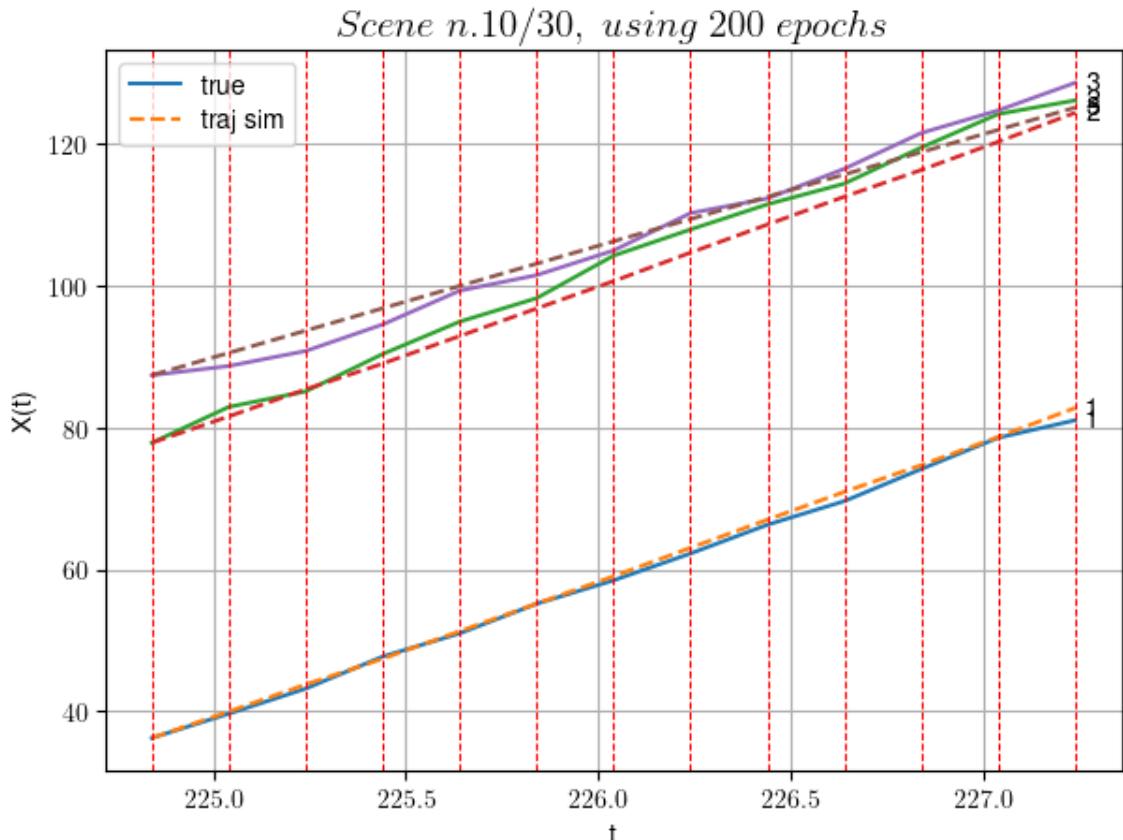
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---

Scene n.10/30, time interval:[224.84,227.24]

---



Loss: 3.347386653960799  
v0 updated: 15.729363702731368

---

---

Scene n.11/30, time interval:[230.84,232.24]

---



Loss: 26.298319432761442  
v0 updated: 23.330054741611075

---

---

Scene n.12/30, time interval:[233.84,235.24]

---

---



Loss: 2.381703925285695  
v0 updated: 21.472180424121877

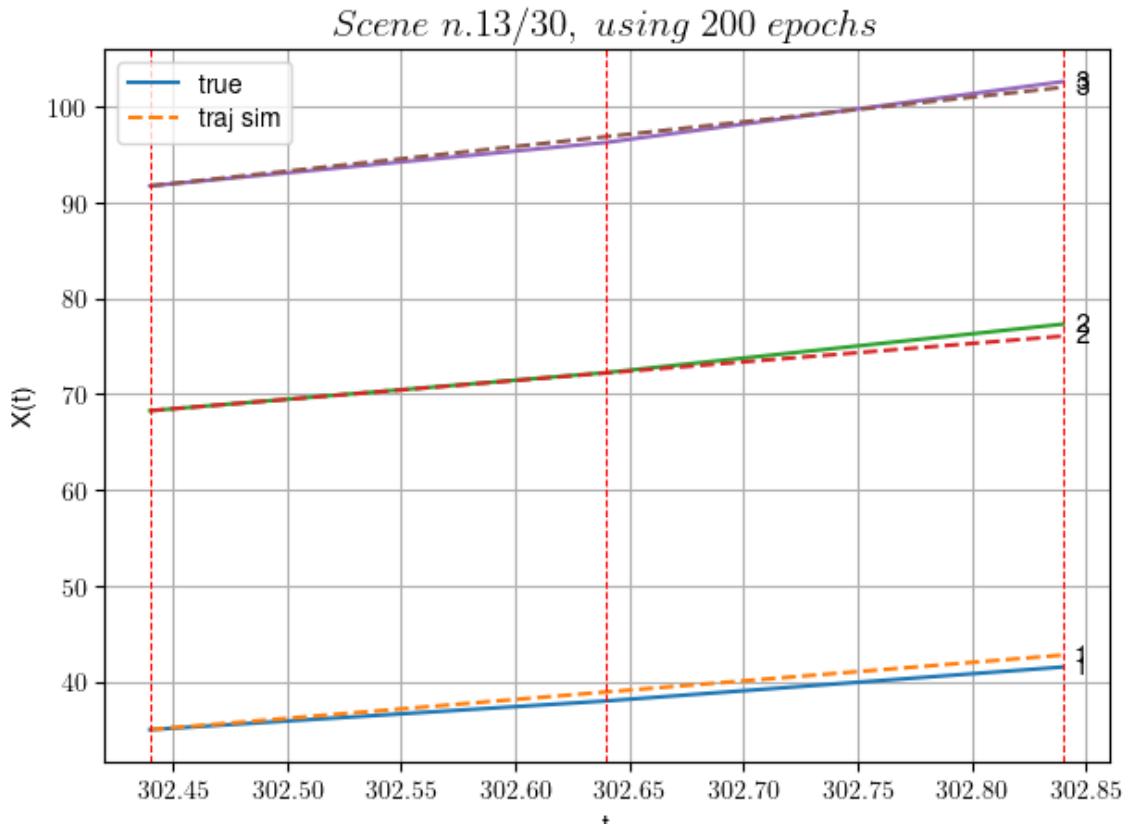
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Scene n.13/30, time interval:[302.44,302.84]

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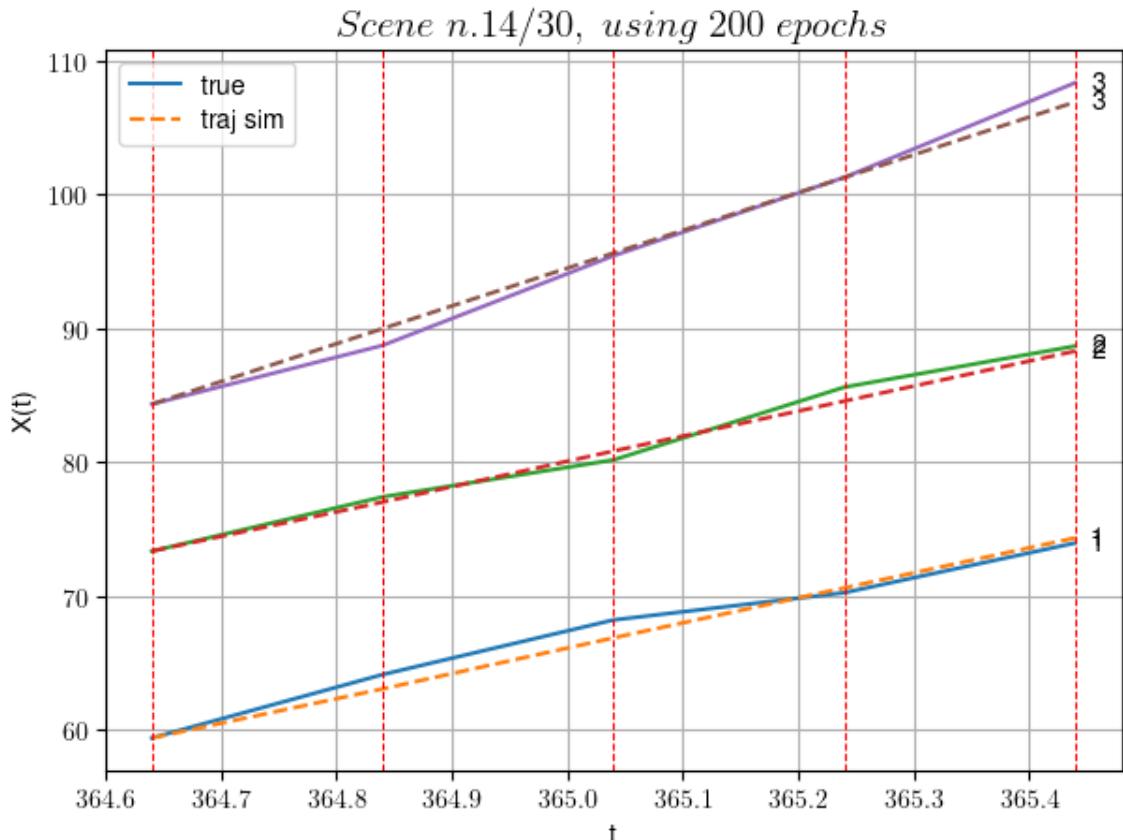
Loss: 0.5251942368077404

v0 updated: 25.749210786691933

---

Scene n.14/30, time interval:[364.64,365.44]

---



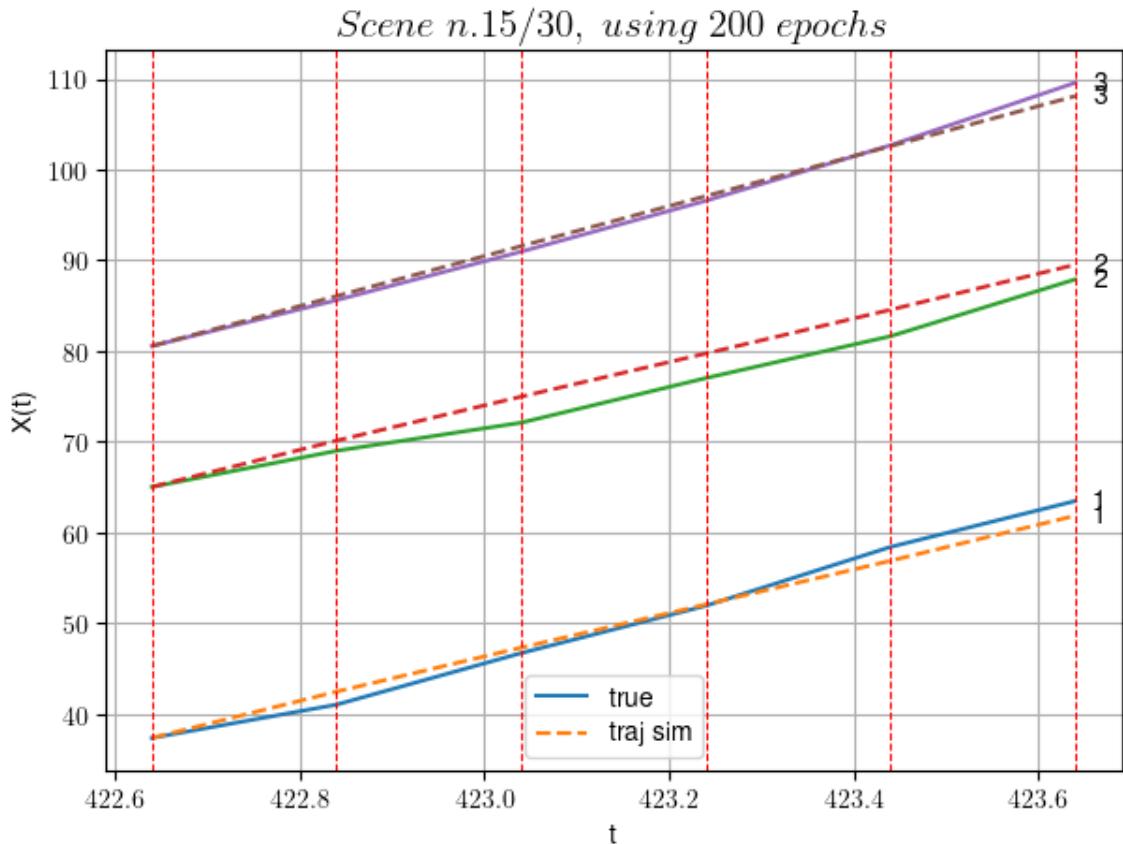
Loss: 0.5800360383648852  
v0 updated: 28.20769503184908

---

---

Scene n.15/30, time interval:[422.64,423.64]

---



Loss: 2.1312441956594683  
v0 updated: 27.54778513206394

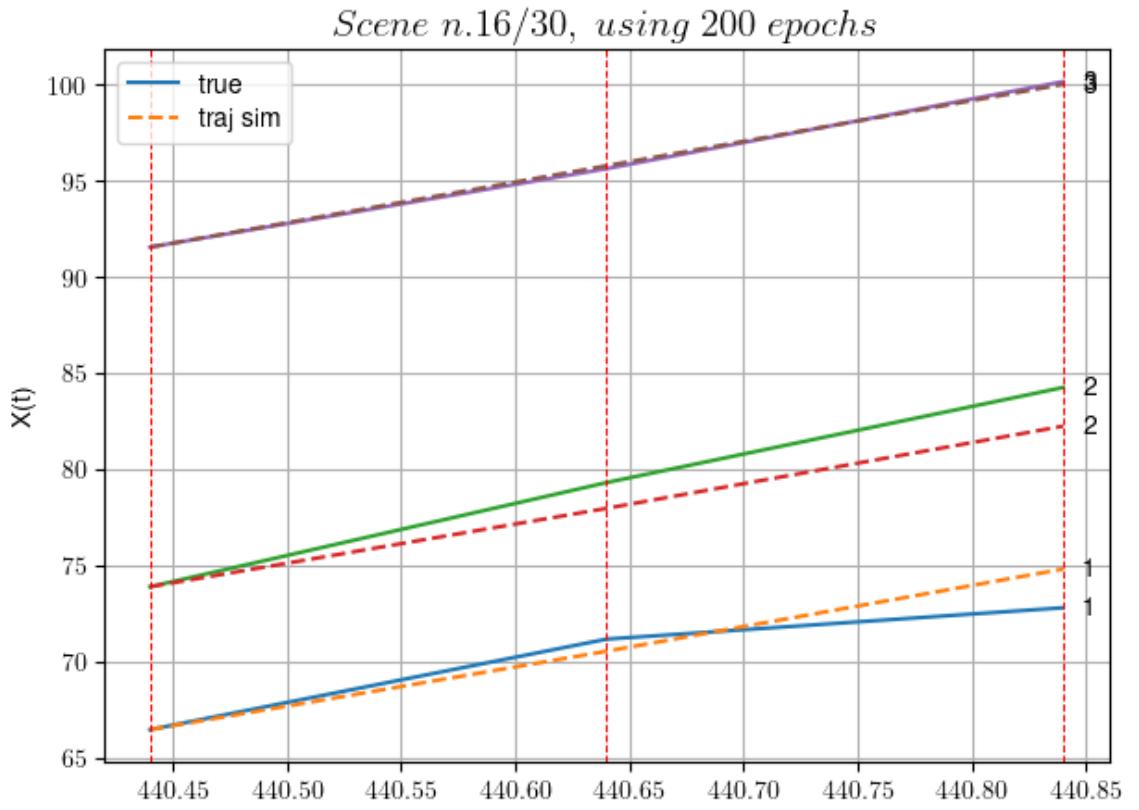
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---

Scene n.16/30, time interval:[440.44,440.84]

---

---



Loss: 1.146009294757162  
v0 updated: 21.13673717572745

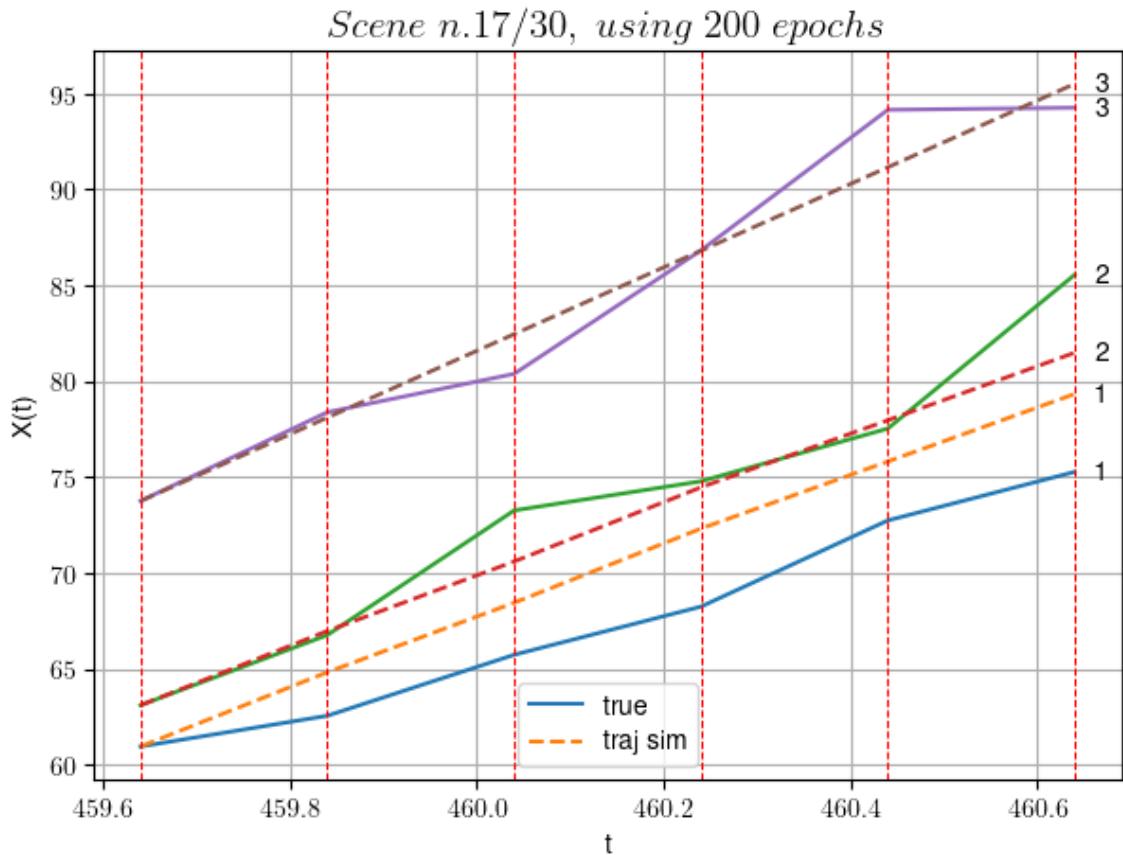
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---

Scene n.17/30, time interval:[459.64,460.64]

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---



Loss: 5.216621353856582  
v0 updated: 21.758536788642303

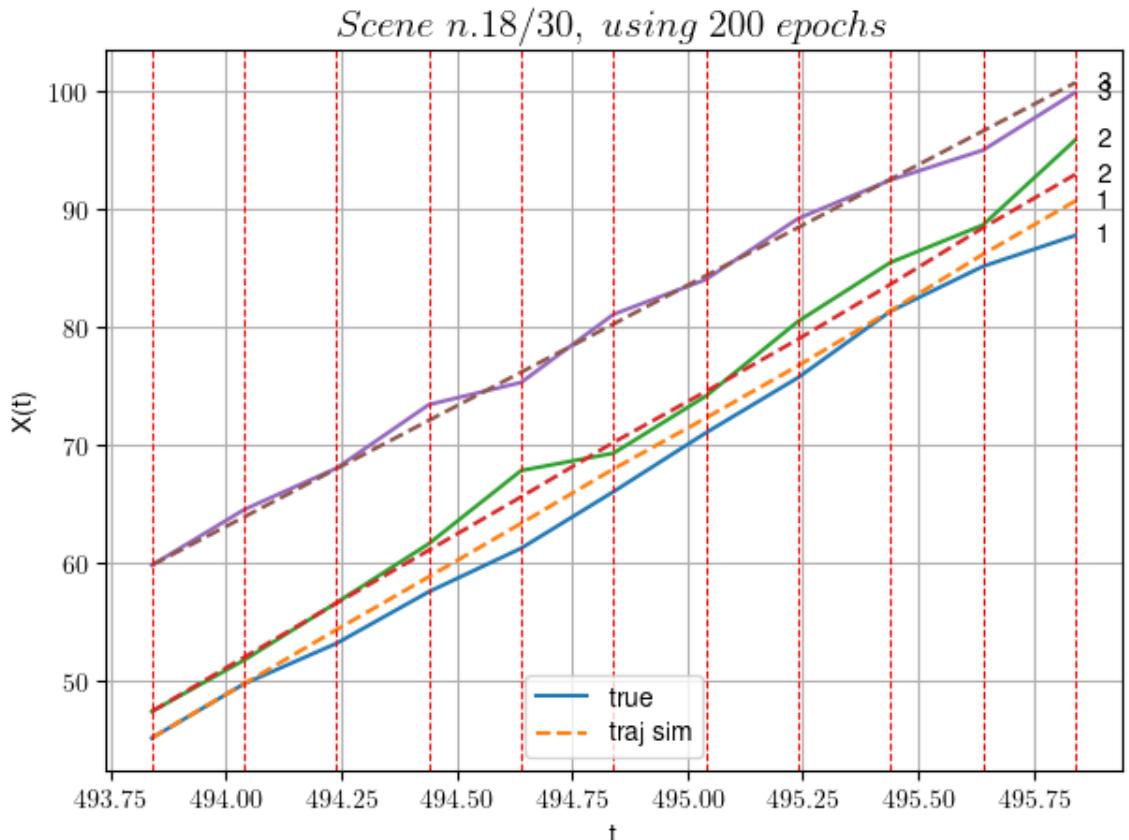
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---

Scene n.18/30, time interval:[493.84,495.84]

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---



Loss: 1.5616017930101886  
v0 updated: 20.44744200453107

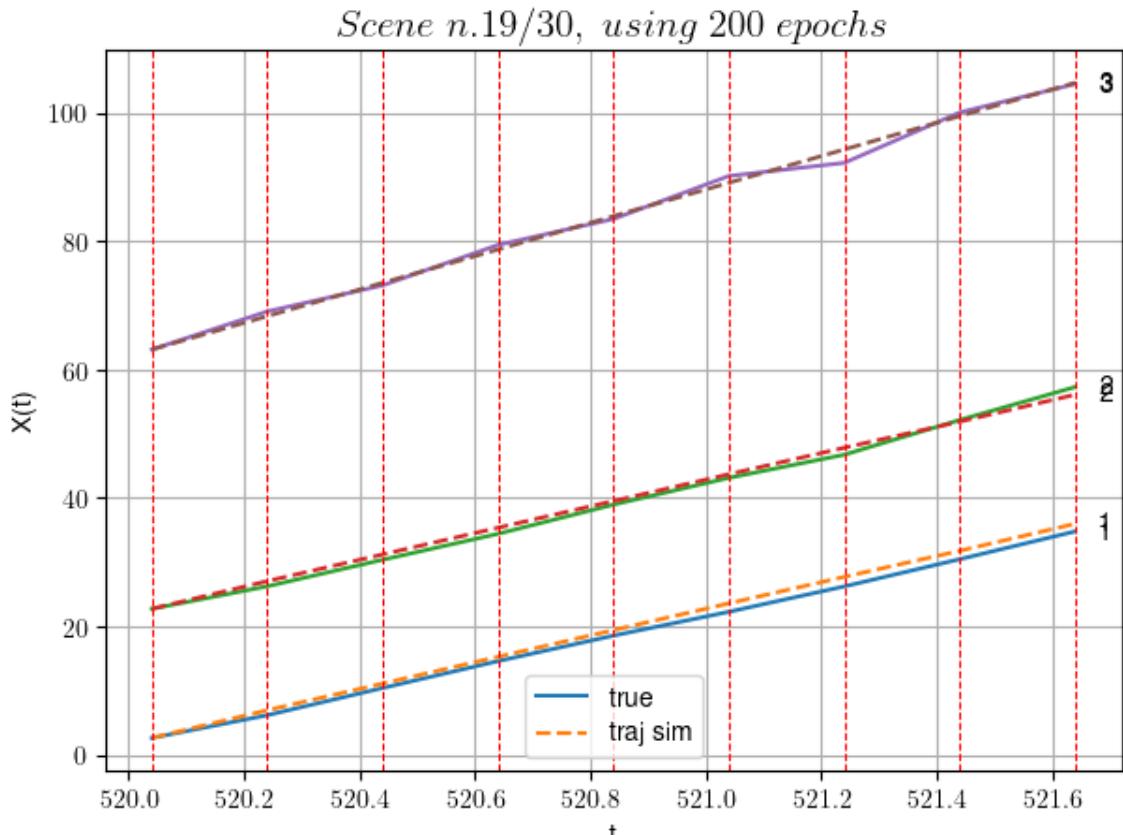
---

---

Scene n.19/30, time interval:[520.04,521.64]

---

---



Loss: 0.819243485095873  
v0 updated: 25.967240218471442

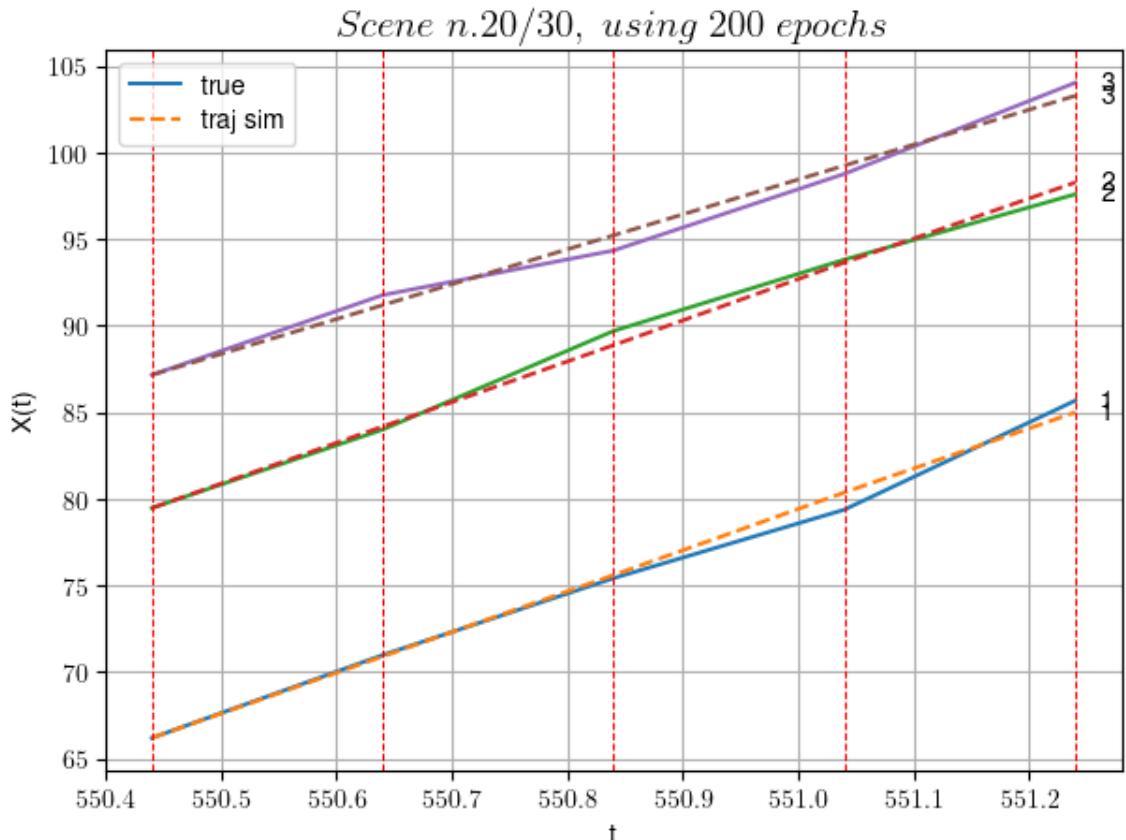
---

---

Scene n.20/30, time interval:[550.44,551.24]

---

---



Loss: 0.3059578033379852  
v0 updated: 20.15921482706291

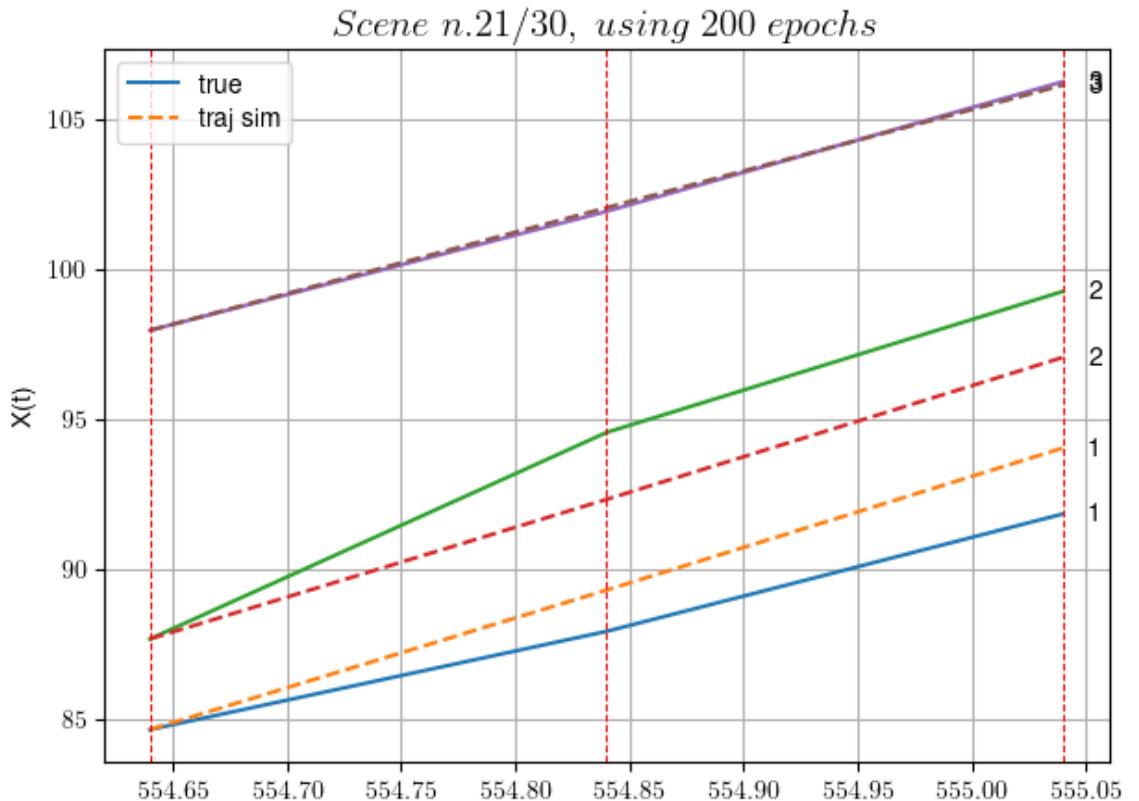
---

---

Scene n.21/30, time interval:[554.64,555.04]

---

---



Loss: 1.8427679422850811  
v0 updated: 20.45122402685835

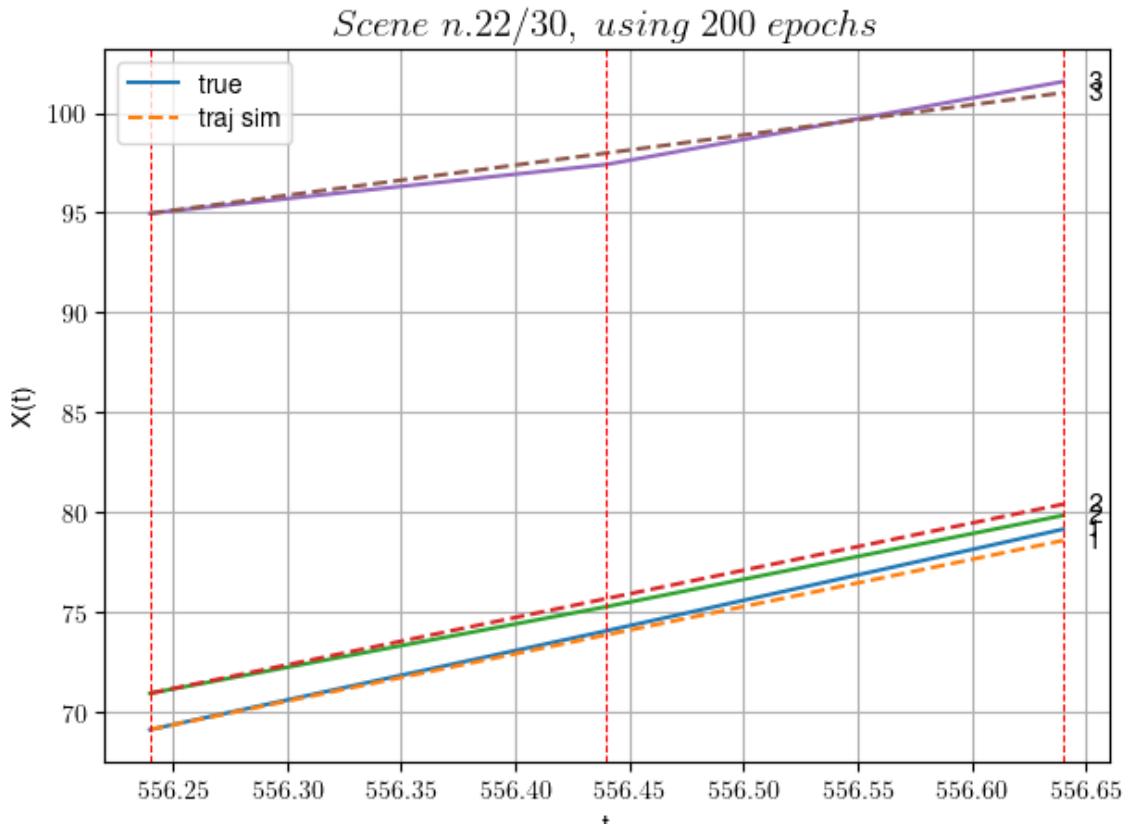
---

---

Scene n.22/30, time interval:[556.24,556.64]

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---



Loss: 0.16466453193991418  
v0 updated: 15.10246810565707

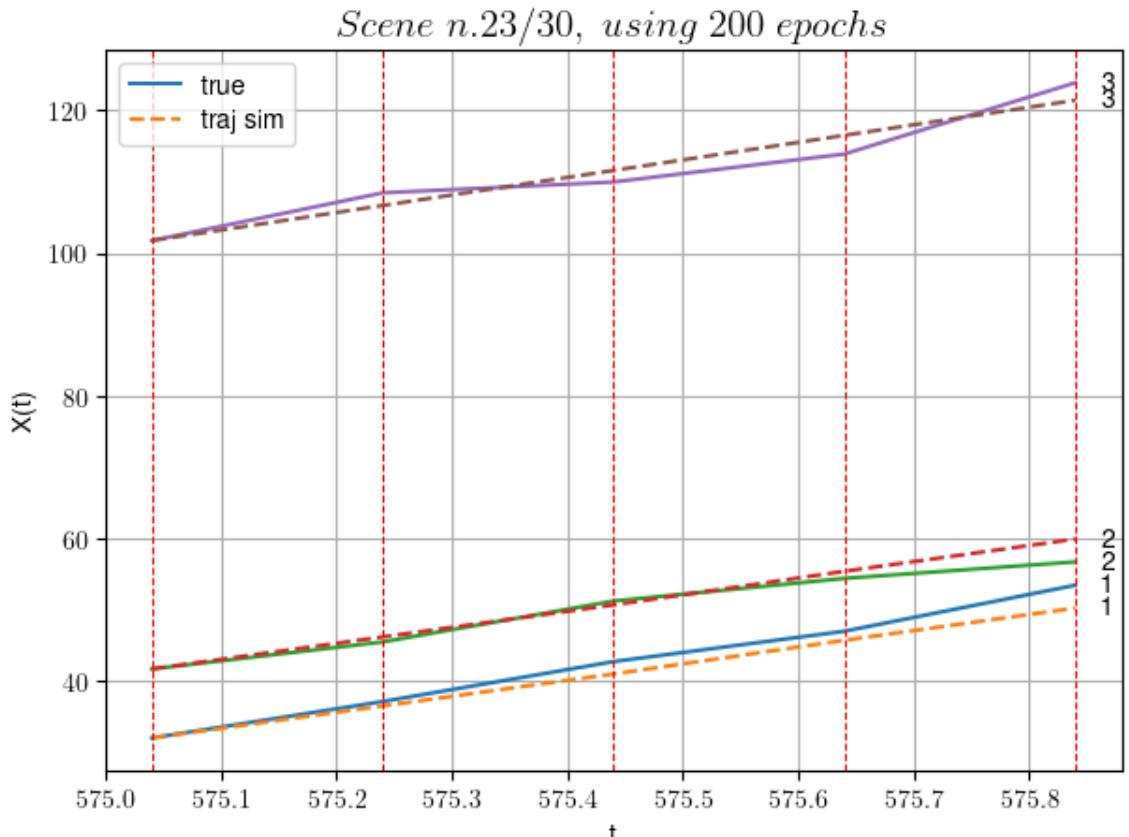
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---

Scene n.23/30, time interval:[575.04,575.84]

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---



Loss: 3.053602406779133  
v0 updated: 24.55161048759143

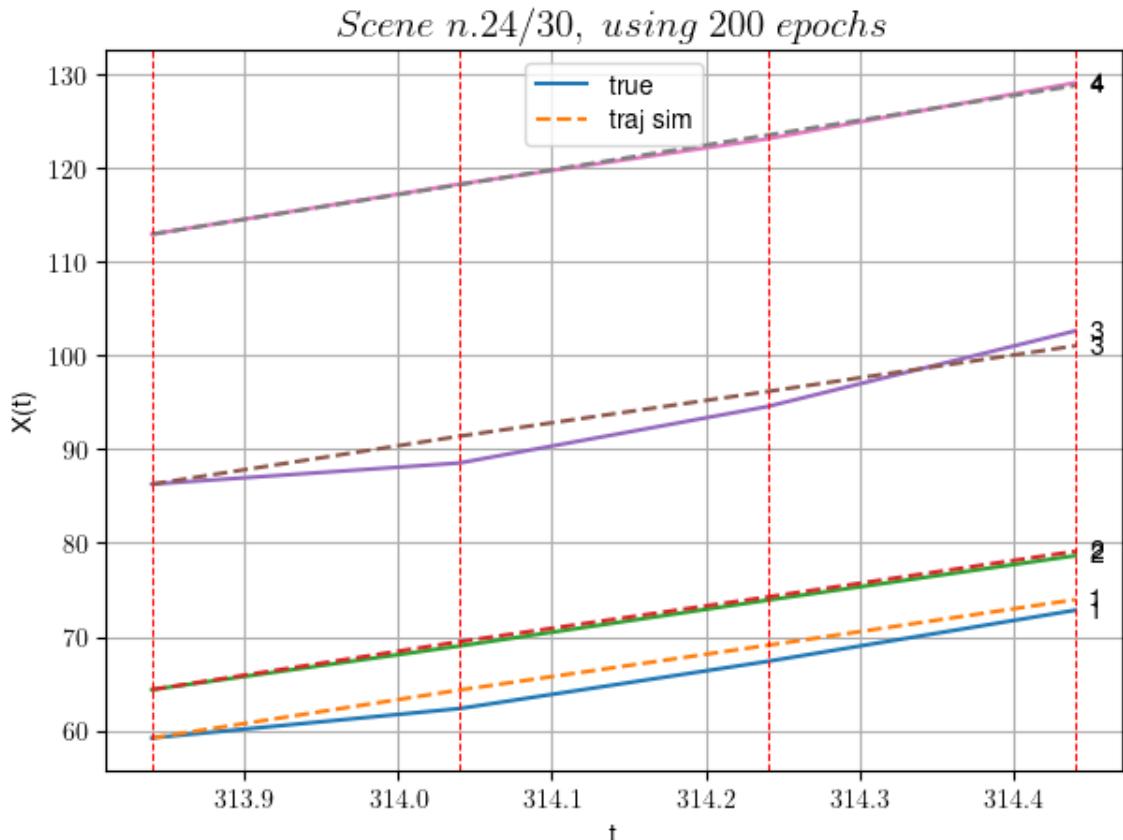
---

---

Scene n.24/30, time interval:[313.84,314.44]

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---



Loss: 1.3878732062538388  
v0 updated: 26.437615898639695

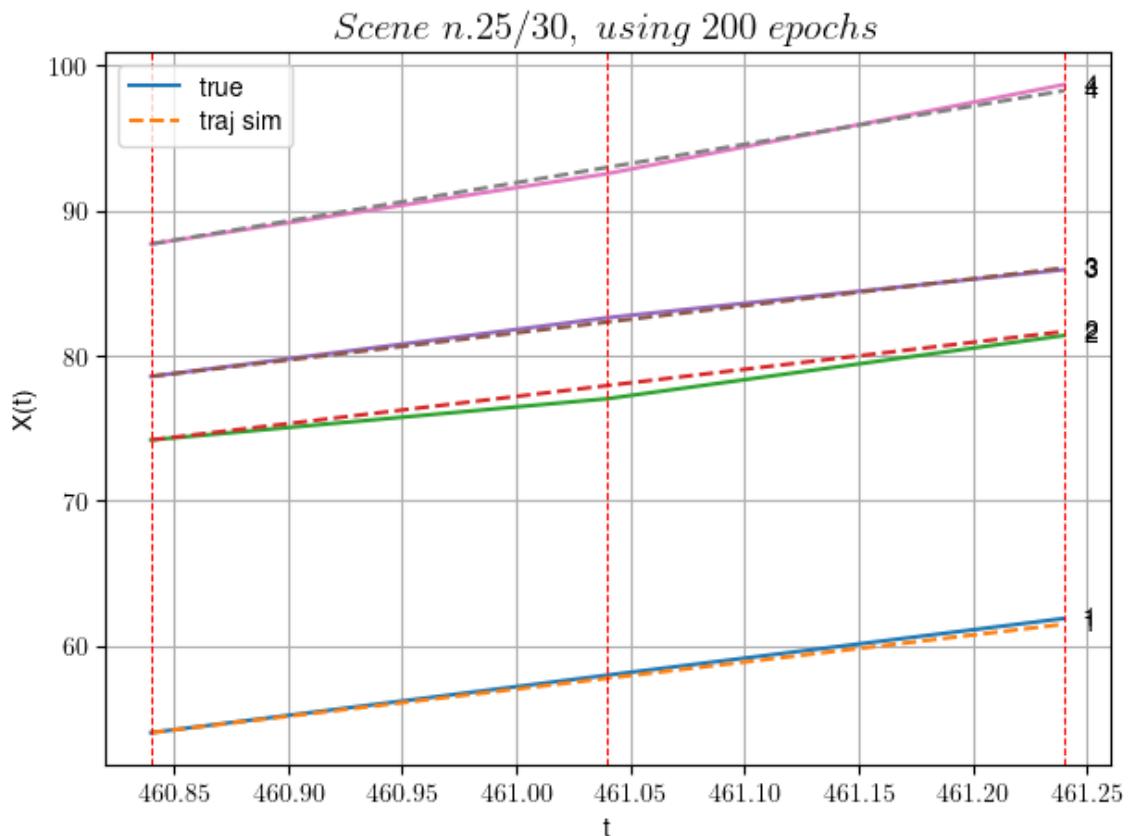
---

---

Scene n.25/30, time interval:[460.84,461.24]

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---



Loss: 0.13042152016940237  
v0 updated: 26.426470006325165

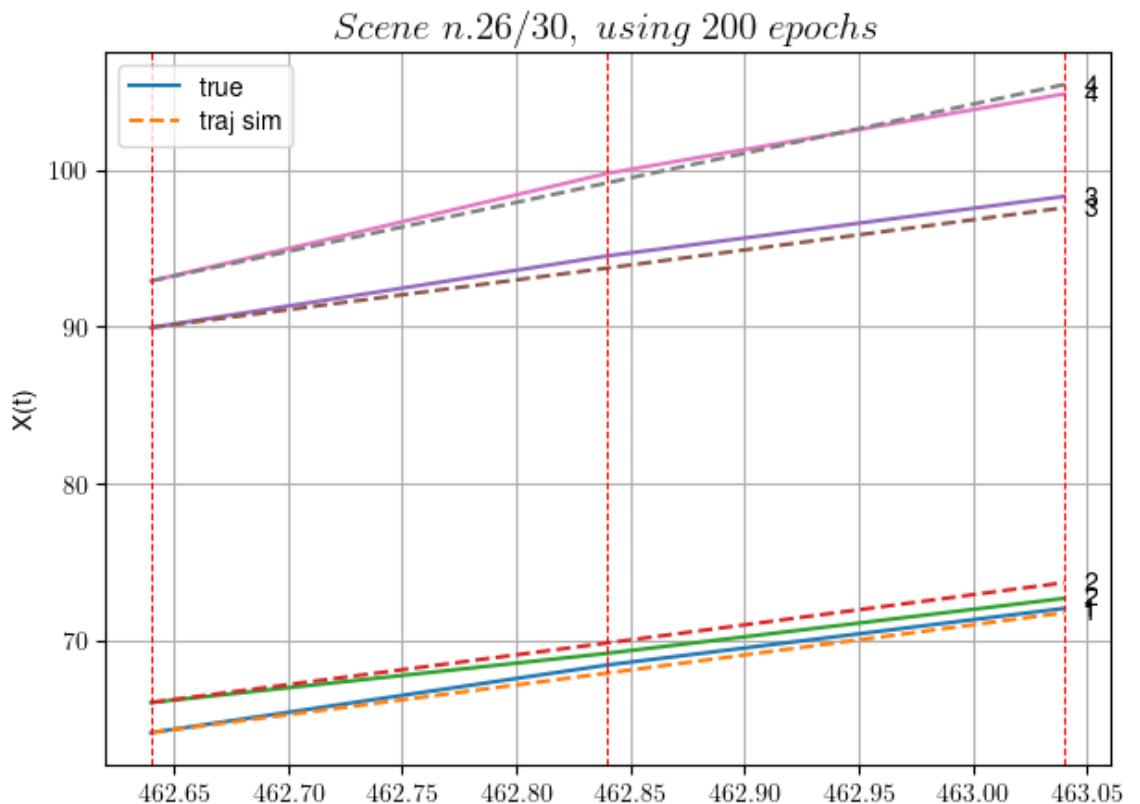
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Scene n.26/30, time interval:[462.64,463.04]

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---



Loss: 0.3027132240814371  
v0 updated: 31.34411385355845

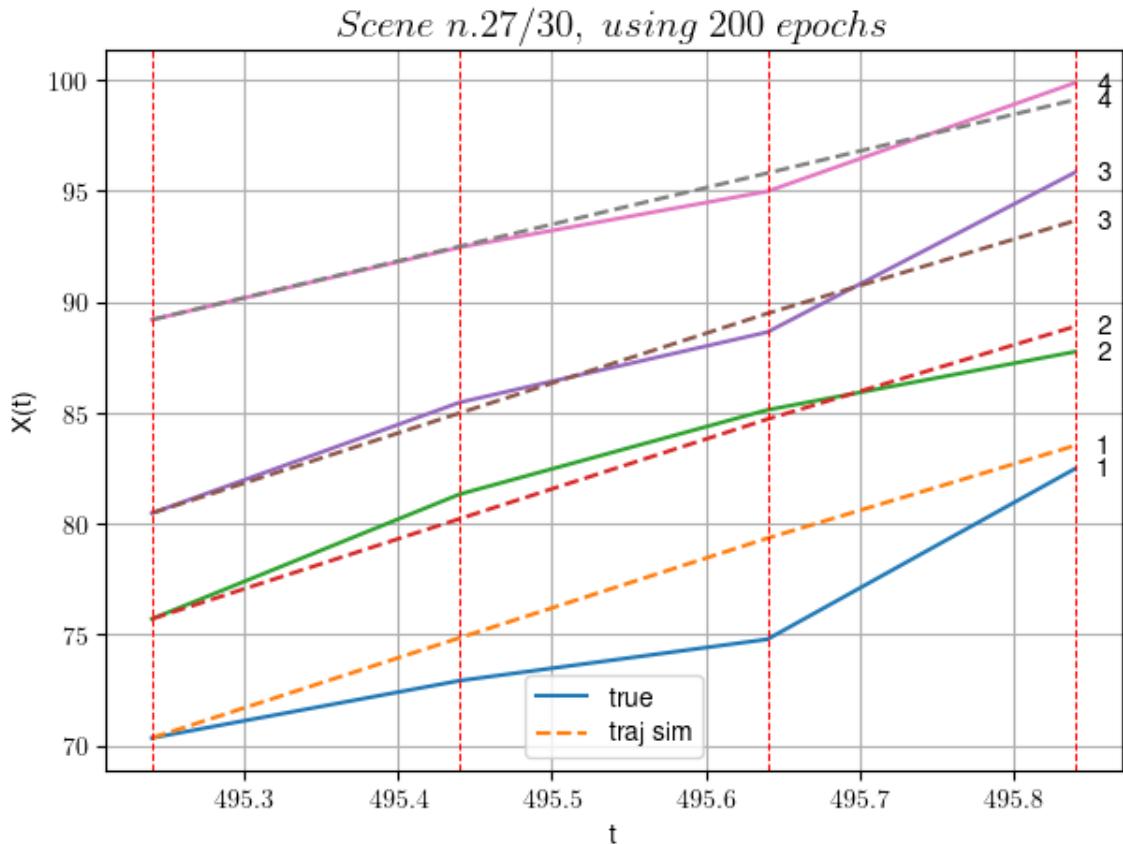
---

---

Scene n.27/30, time interval:[495.24,495.84]

---

---



Loss: 2.200974446666891  
v0 updated: 16.521371437174743

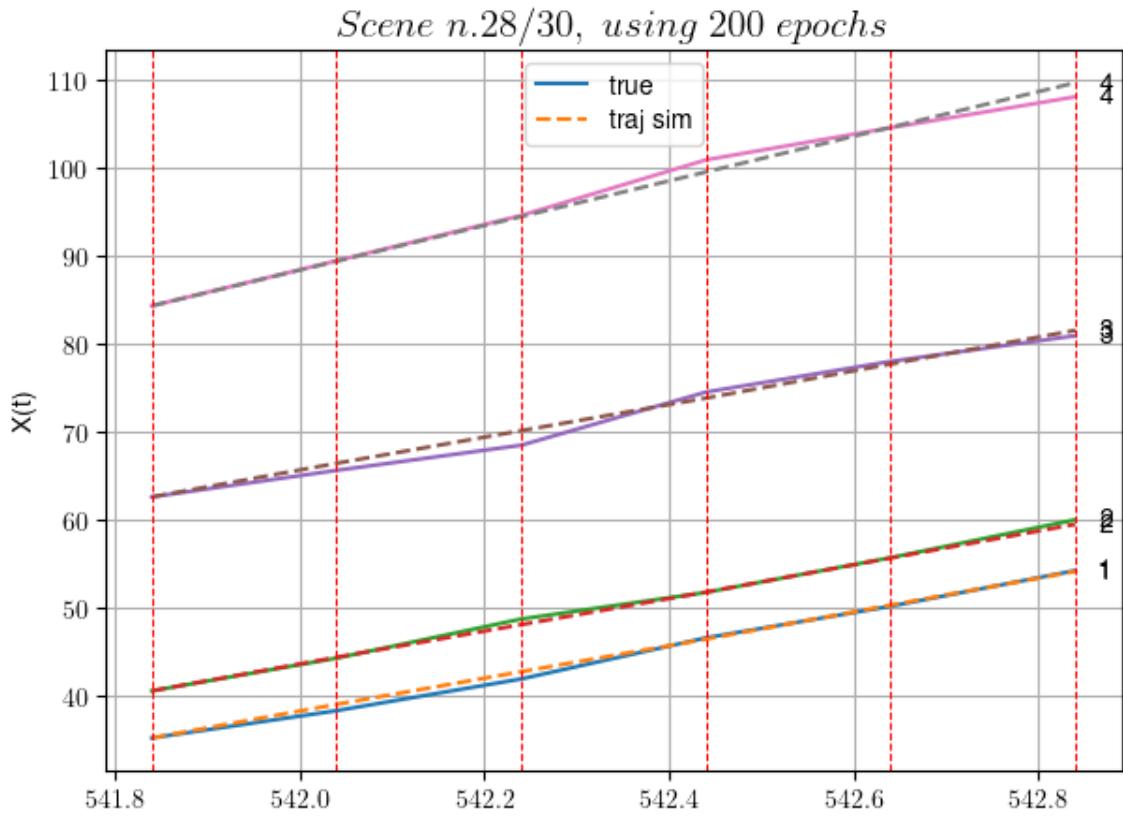
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---

Scene n.28/30, time interval:[541.84,542.84]

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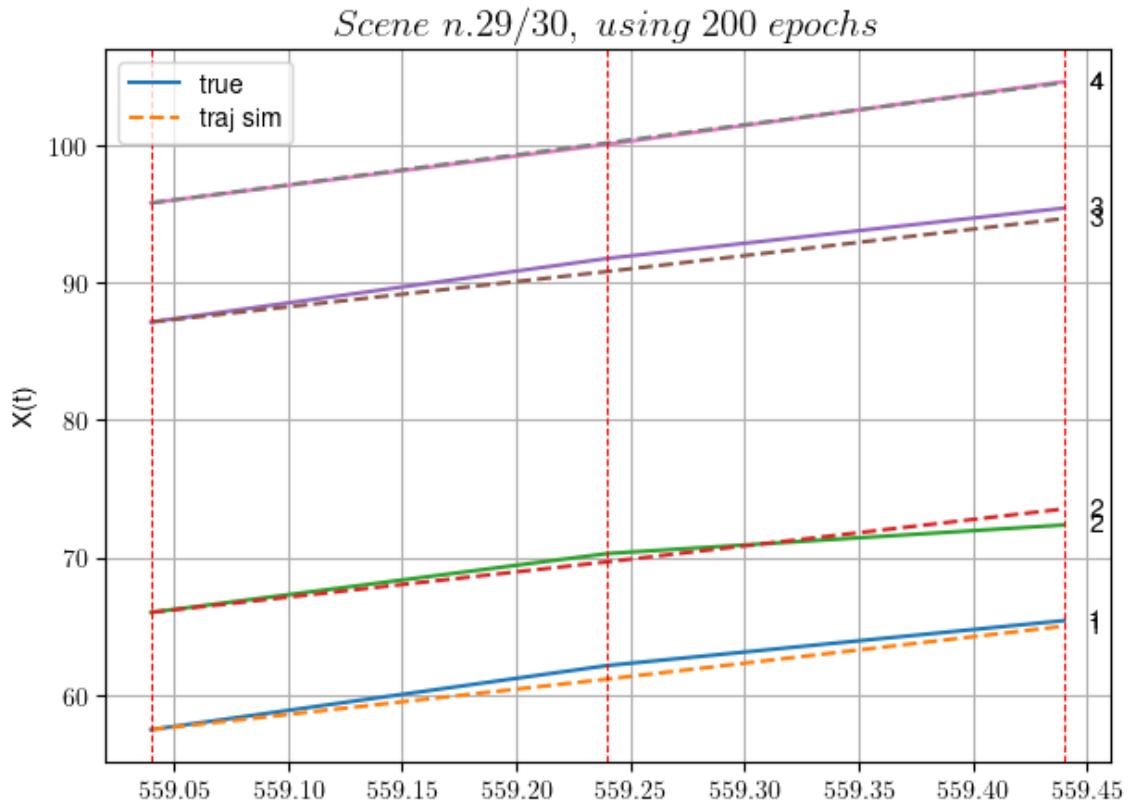


Loss: 0.44570741071986864  
v0 updated: 25.34048009127371

---

Scene n.29/30, time interval:[559.04,559.44]

---



Loss: 0.36481085034621313  
v0 updated: 21.871231487187927

---

---

v0\_mean in this df is: 24.67864805402919  
Time taken: 193.54s  
Hidden-Layer-1/kernel:0: [-1543128.6 -2946.929]  
Hidden-Layer-1/bias:0: [-76481.914 -237.7462]  
Output-Layer/kernel:0: [-1.2088498e+06 -3.2554160e+02]  
Output-Layer/bias:0: [18.39388]

---

---

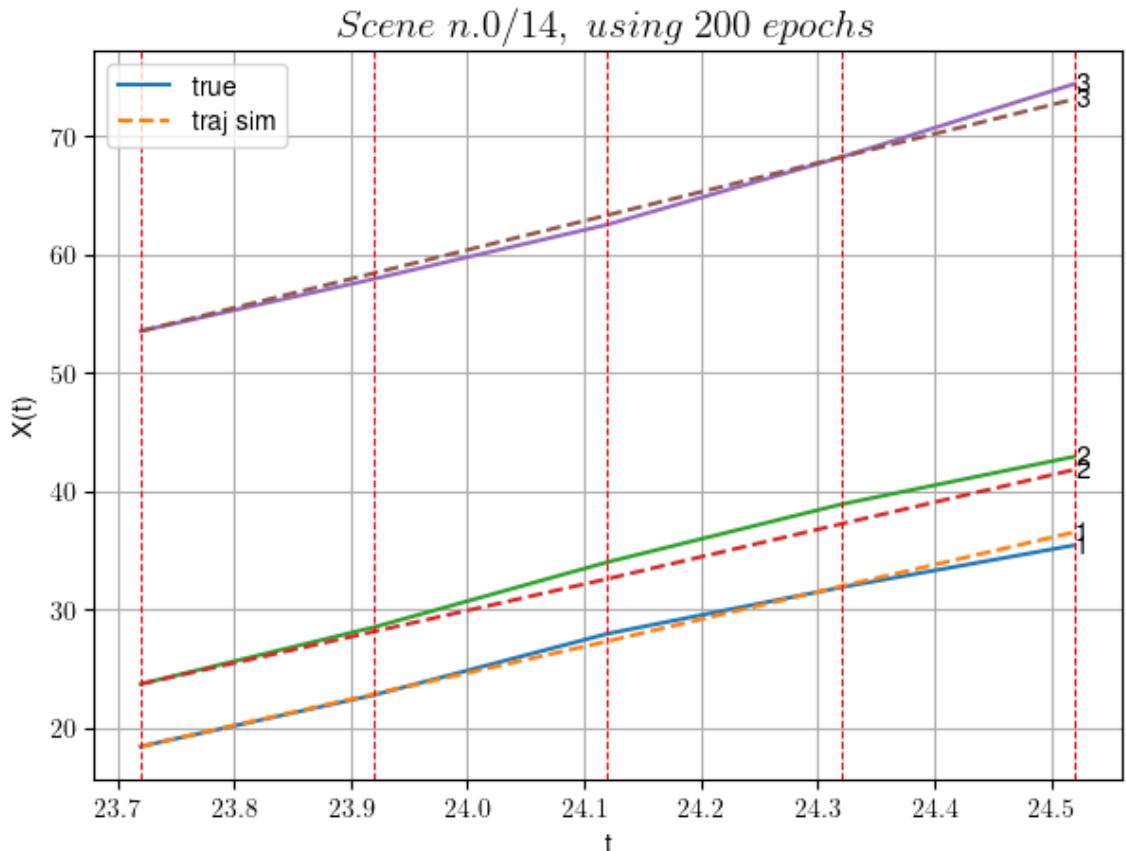
In df n.5/10 we have 14 scenes

---

Scene n.0/14, time interval:[23.72,24.52]

---

---



Loss: 0.6879698711538809  
v0 updated: 24.540804592766374

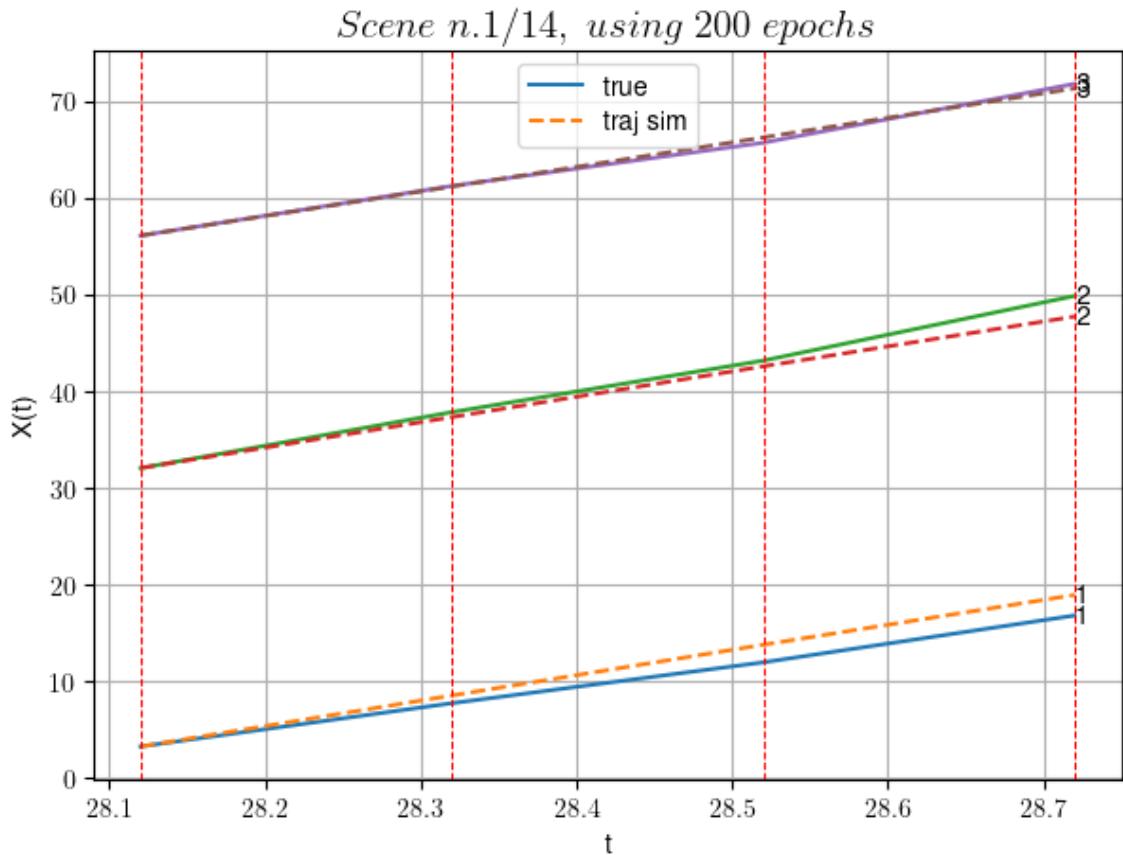
---

---

Scene n.1/14, time interval:[28.12,28.72]

---

---



Loss: 1.180089782740242  
v0 updated: 25.38445729058461

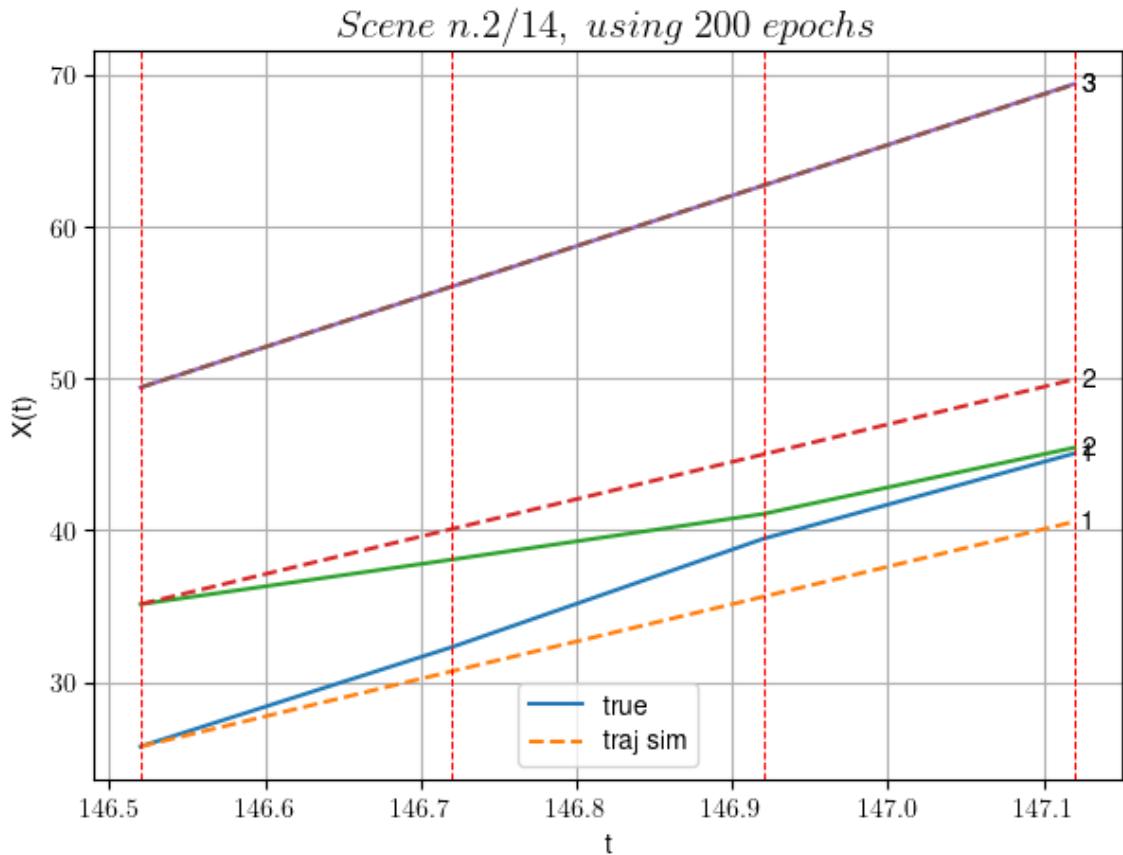
---

---

Scene n.2/14, time interval:[146.52,147.12]

---

---



Loss: 6.399567259373039  
v0 updated: 33.24361982546581

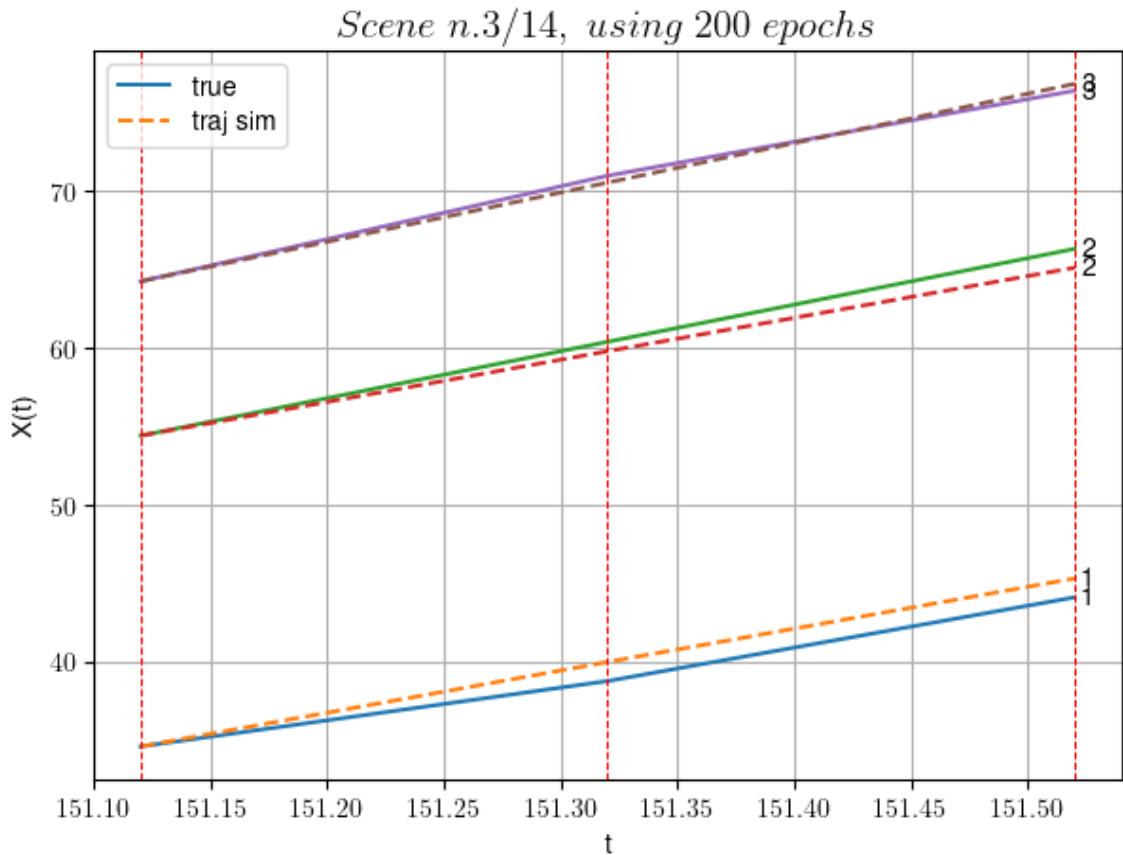
---

---

Scene n.3/14, time interval:[151.12,151.52]

---

---



Loss: 0.5682709199537672  
v0 updated: 31.514473997442256

---

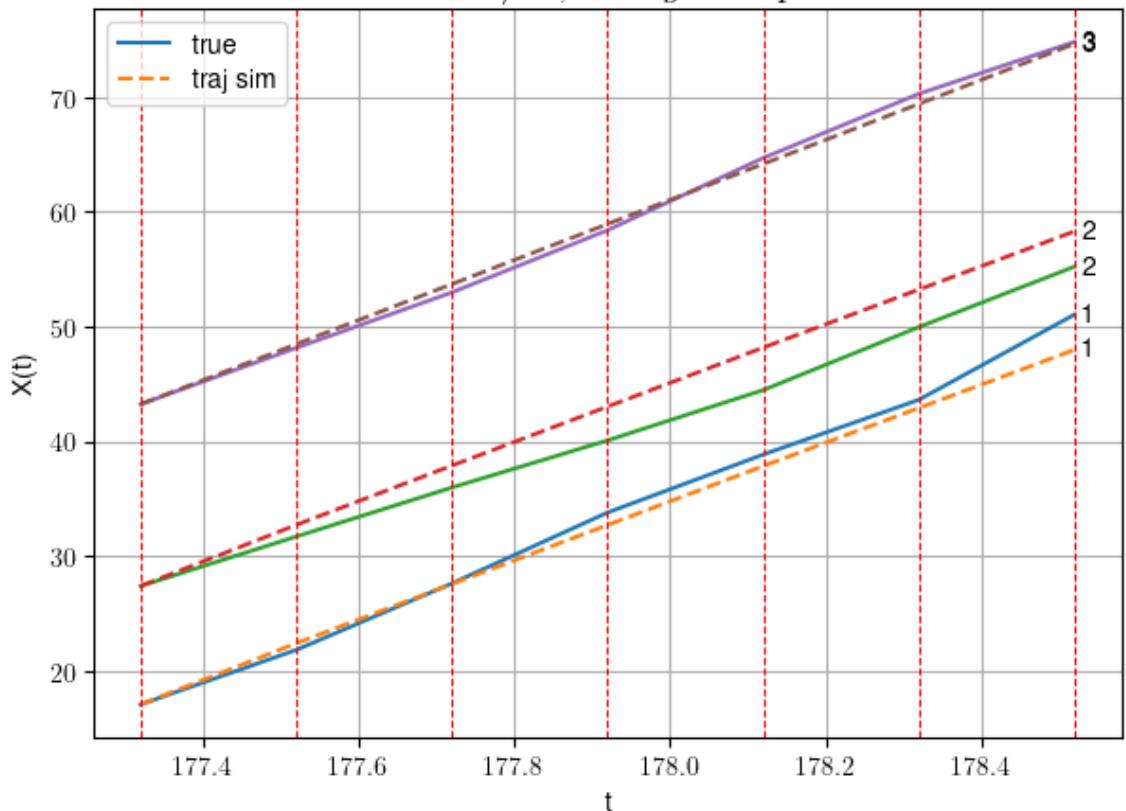
---

Scene n.4/14, time interval:[177.32,178.52]

---

---

Scene n.4/14, using 200 epochs

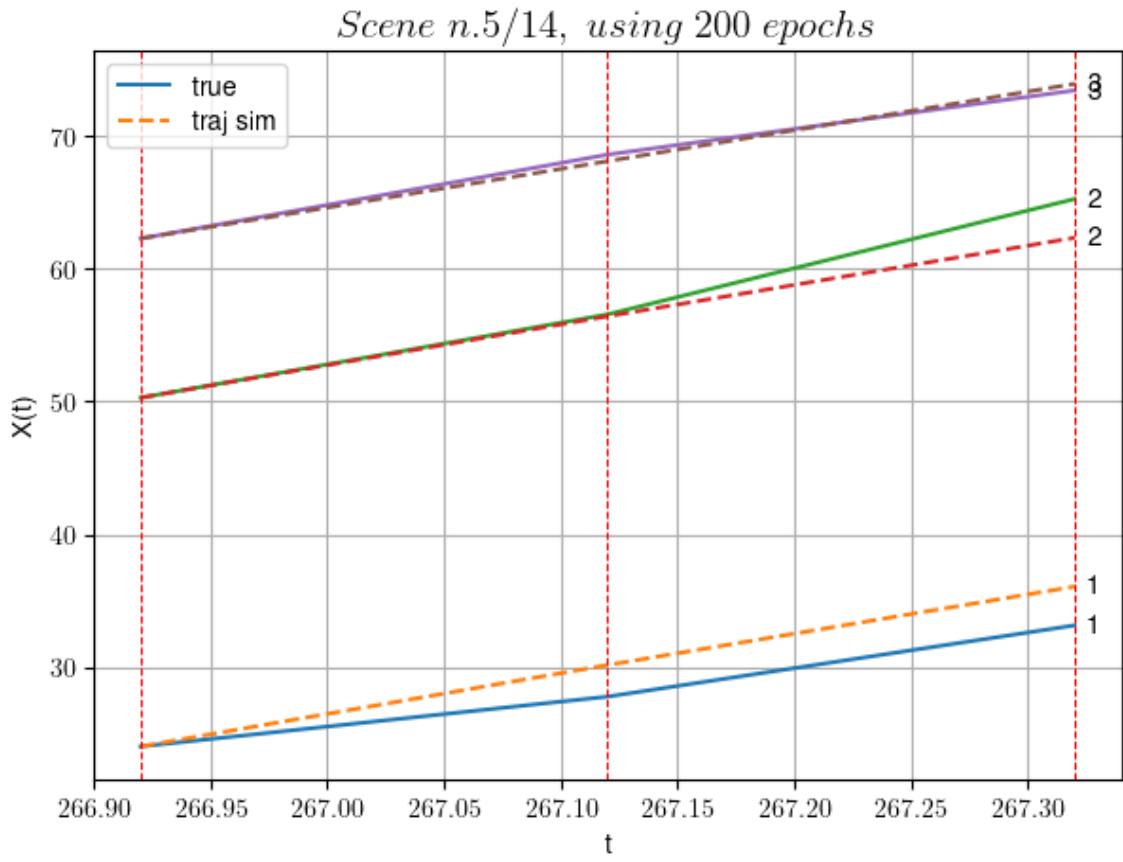


Loss: 2.9389605605339555  
v0 updated: 26.18457238016555

---

Scene n.5/14, time interval:[266.92,267.32]

---



Loss: 2.577861980685881  
v0 updated: 29.08670553770542

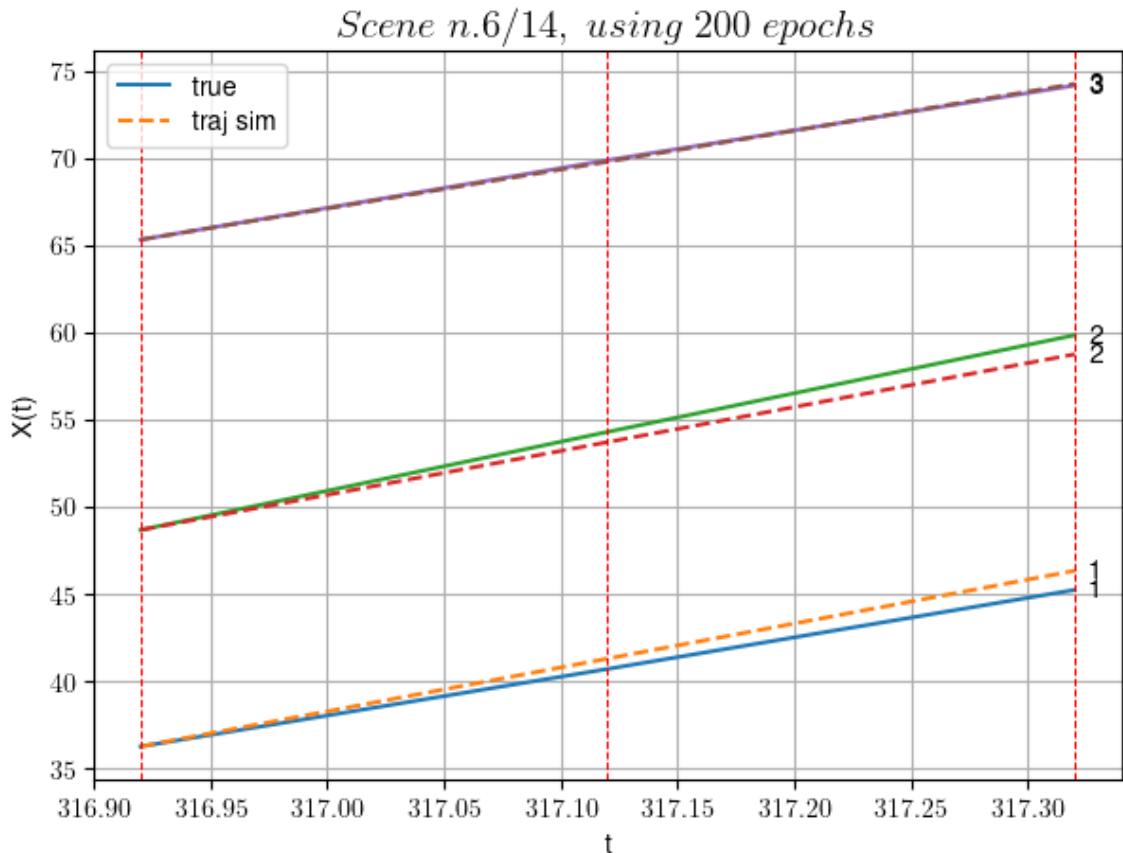
---

---

Scene n.6/14, time interval:[316.92,317.32]

---

---



Loss: 0.34613677476566224  
v0 updated: 22.350454396791342

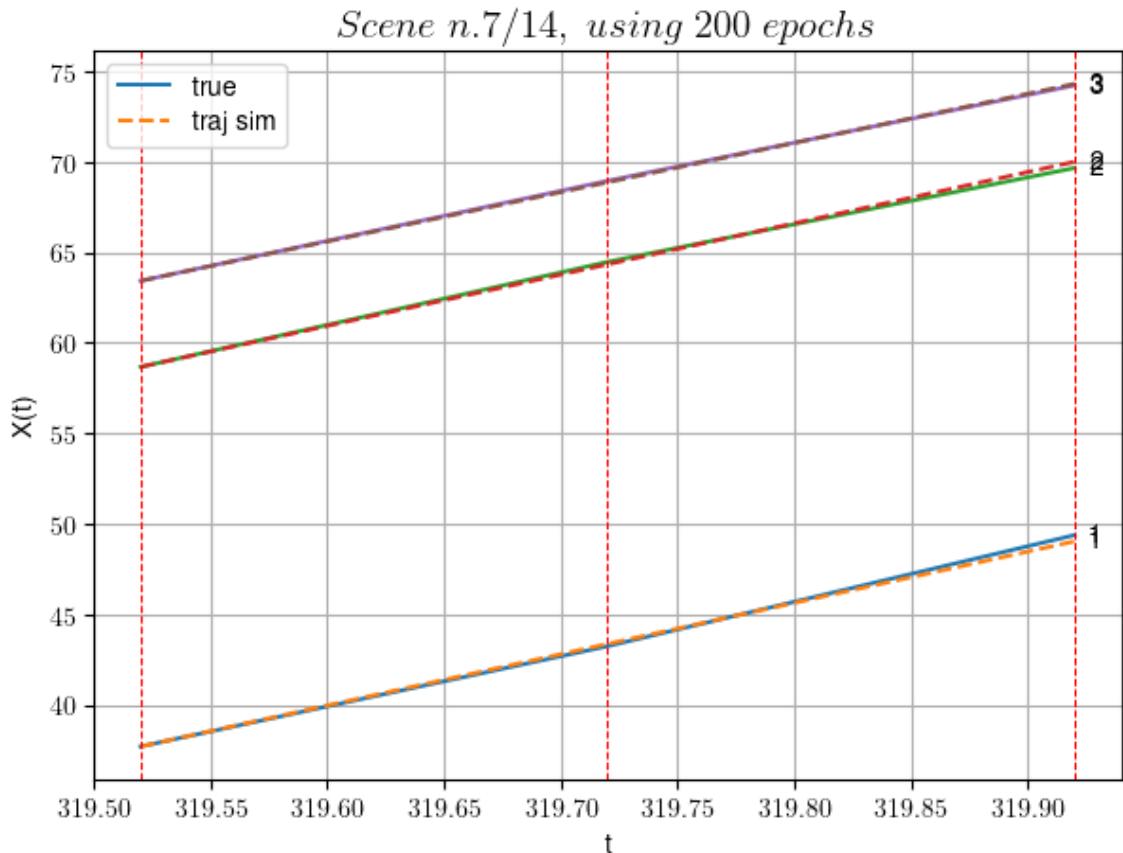
---

---

Scene n.7/14, time interval:[319.52,319.92]

---

---



Loss: 0.03174788545450367  
v0 updated: 27.22550971636396

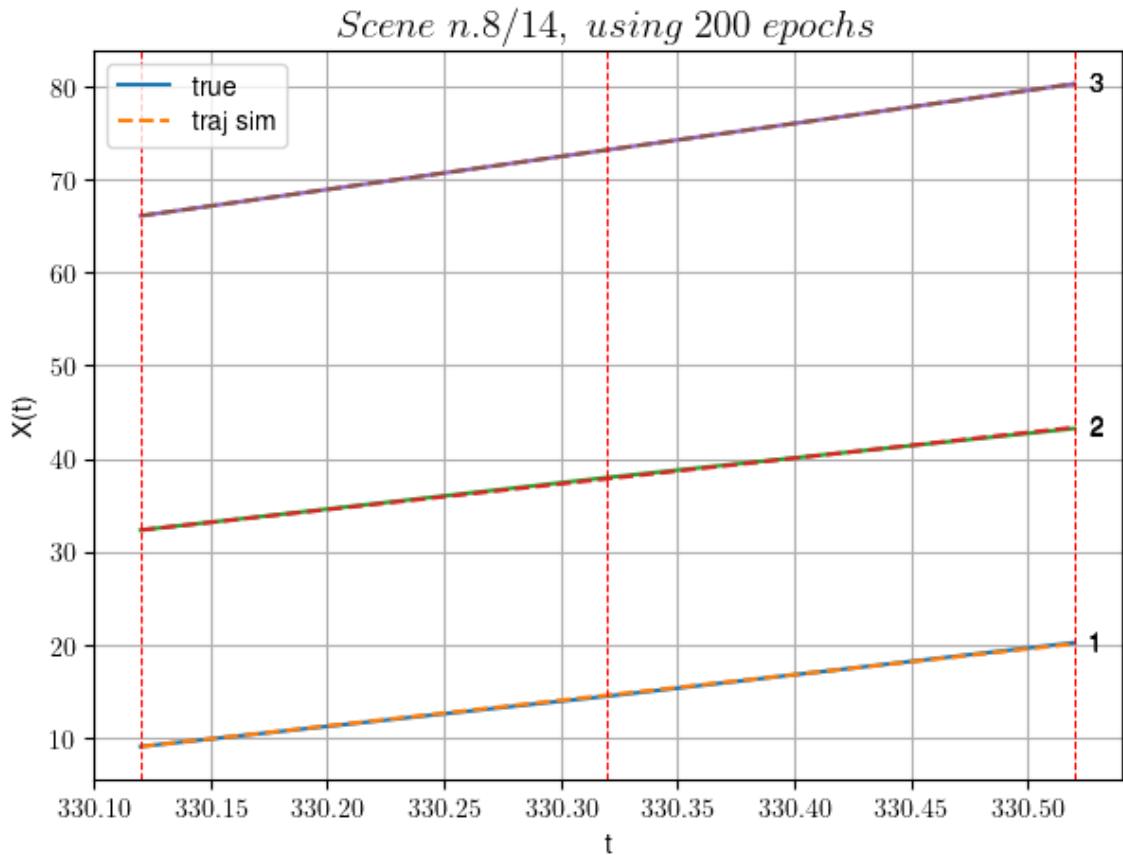
---

---

Scene n.8/14, time interval:[330.12,330.52]

---

---



Loss: 0.006576960175479862  
v0 updated: 35.47266760034579

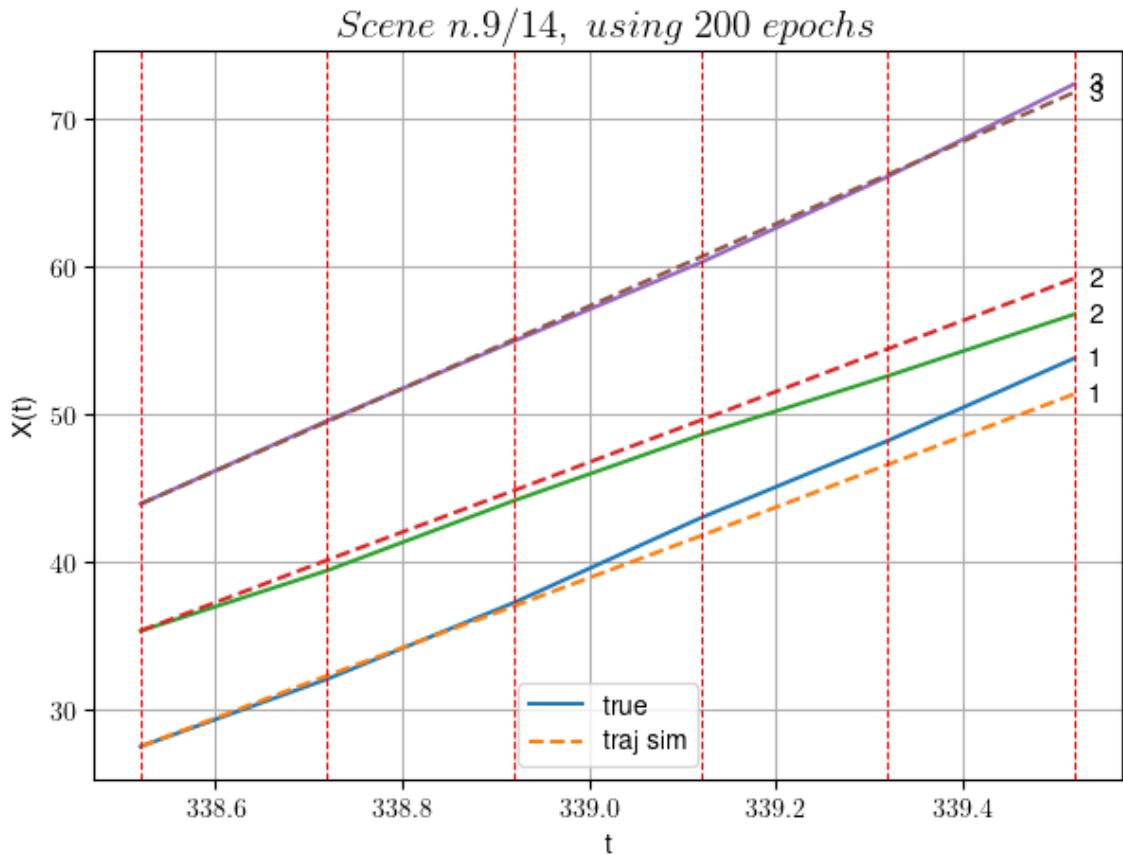
---

---

Scene n.9/14, time interval:[338.52,339.52]

---

---



Loss: 1.206951571967755  
v0 updated: 27.856284841251647

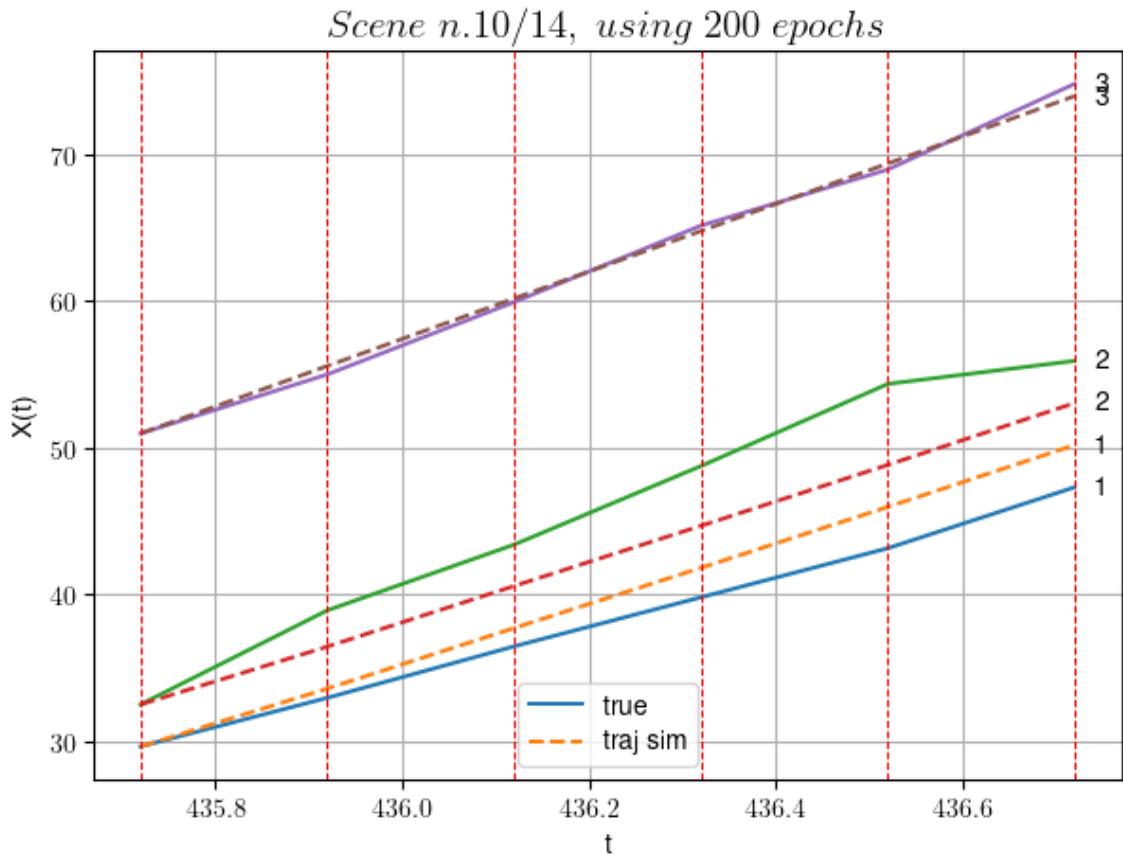
---

---

Scene n.10/14, time interval:[435.72,436.72]

---

---



Loss: 5.169256646940307  
v0 updated: 23.00995307931417

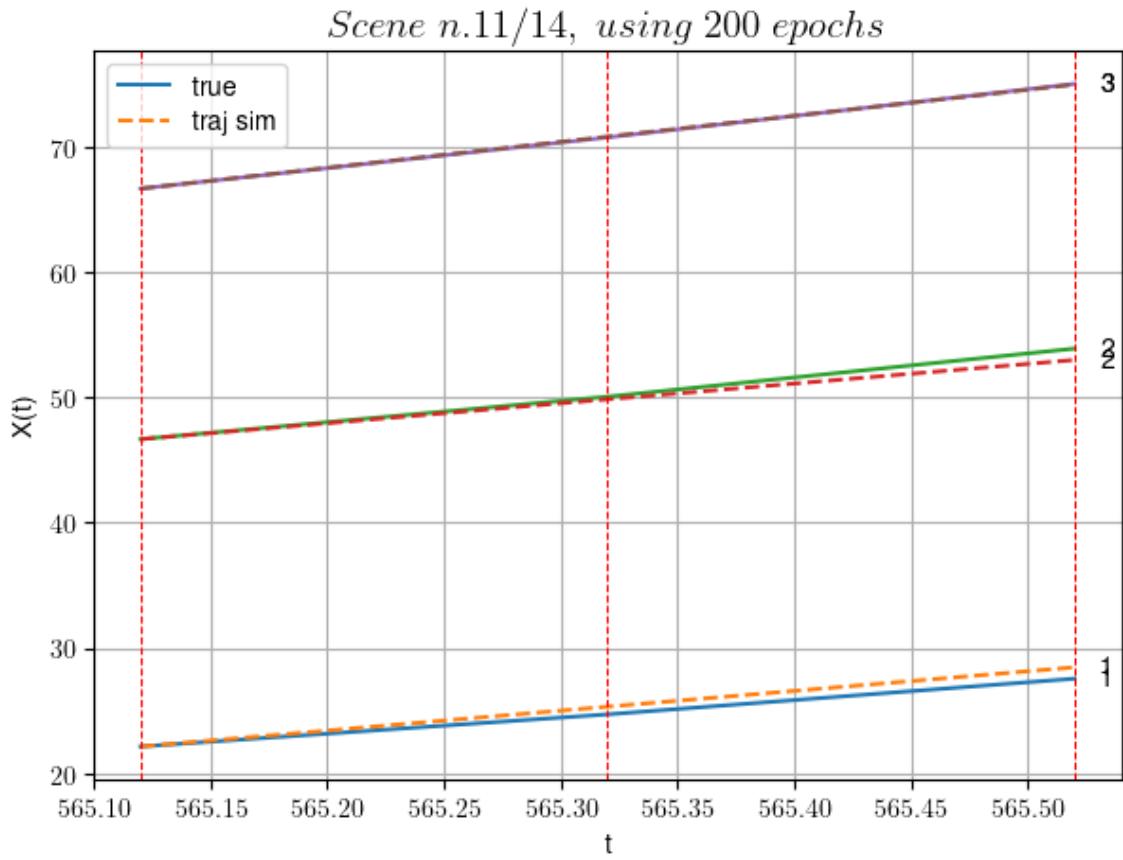
---

---

Scene n.11/14, time interval:[565.12,565.52]

---

---



Loss: 0.23052335029690155  
v0 updated: 20.76046991302415

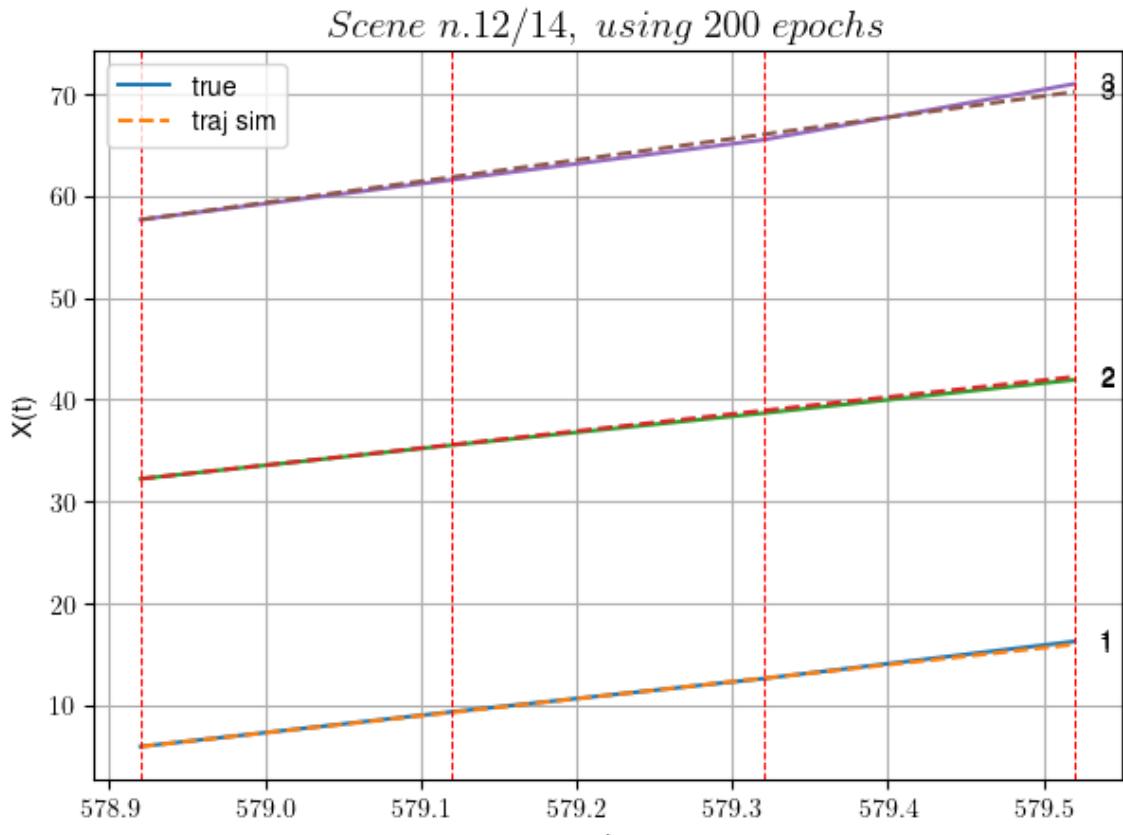
---

---

Scene n.12/14, time interval:[578.92,579.52]

---

---



Loss: 0.10131812526362068  
v0 updated: 20.92658502941081

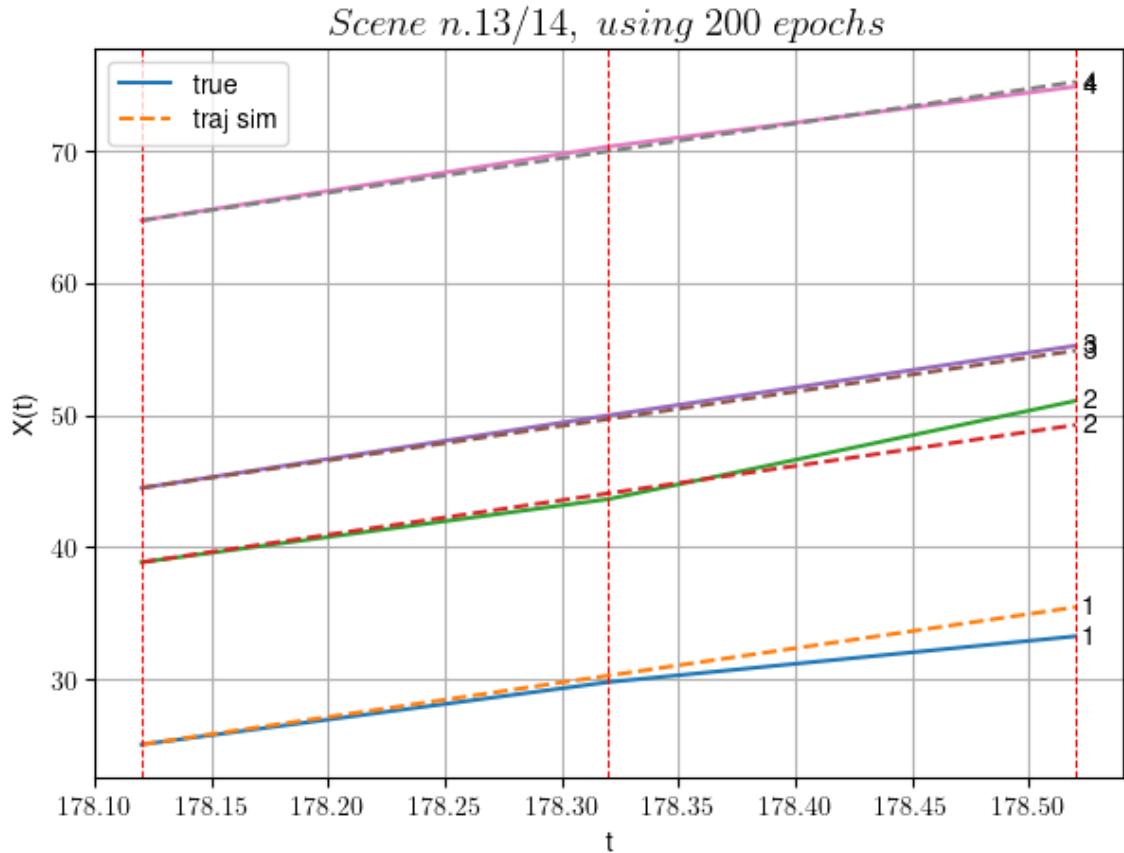
---

---

Scene n.13/14, time interval:[178.12,178.52]

---

---



Loss: 0.75631511870789  
v0 updated: 26.21582356930081

---



---

v0\_mean in this df is: 27.19929737761663  
Time taken: 68.76s  
Hidden-Layer-1/kernel:0: [-1543128.6 -2946.929]  
Hidden-Layer-1/bias:0: [-76481.914 -237.7462]  
Output-Layer/kernel:0: [-1.2088498e+06 -3.2554160e+02]  
Output-Layer/bias:0: [26.078182]

---



---

In df n.6/10 we have 3 scenes

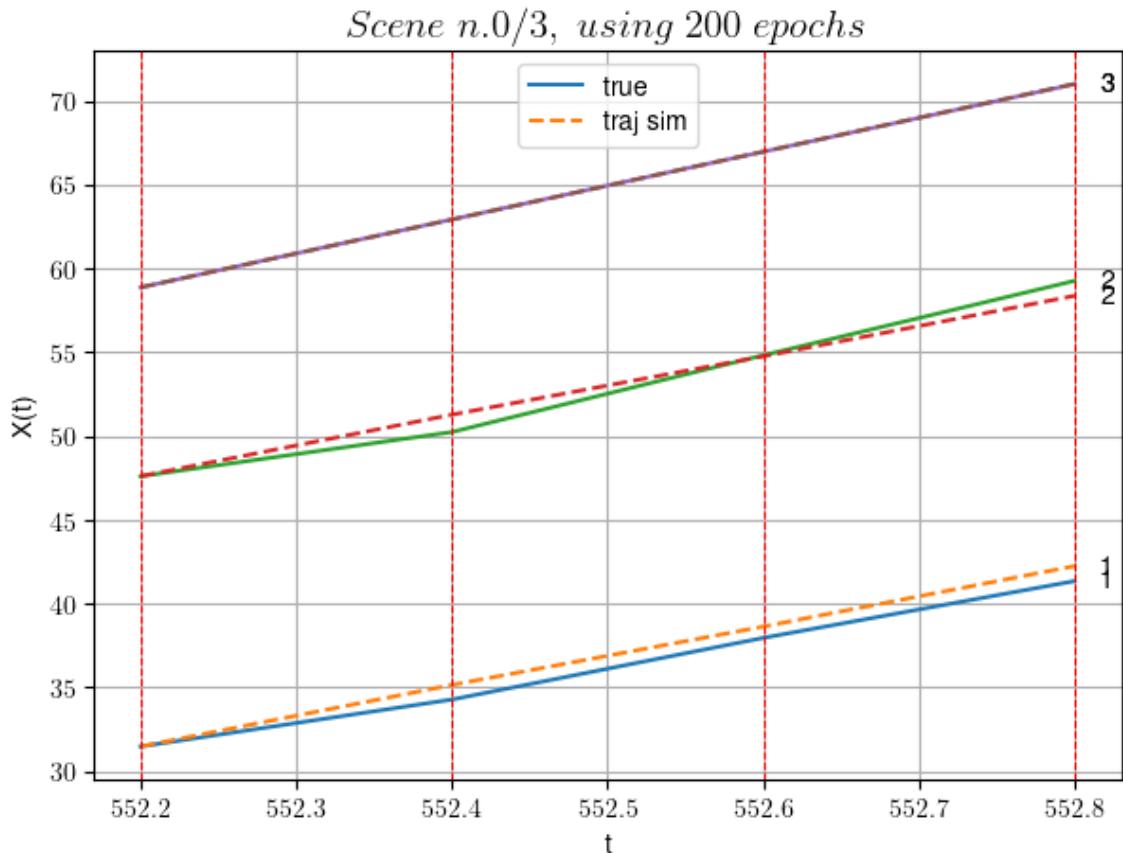
---

Scene n.0/3, time interval:[552.20,552.80]

---



---



Loss: 0.32439807488629924  
v0 updated: 20.243929110422304

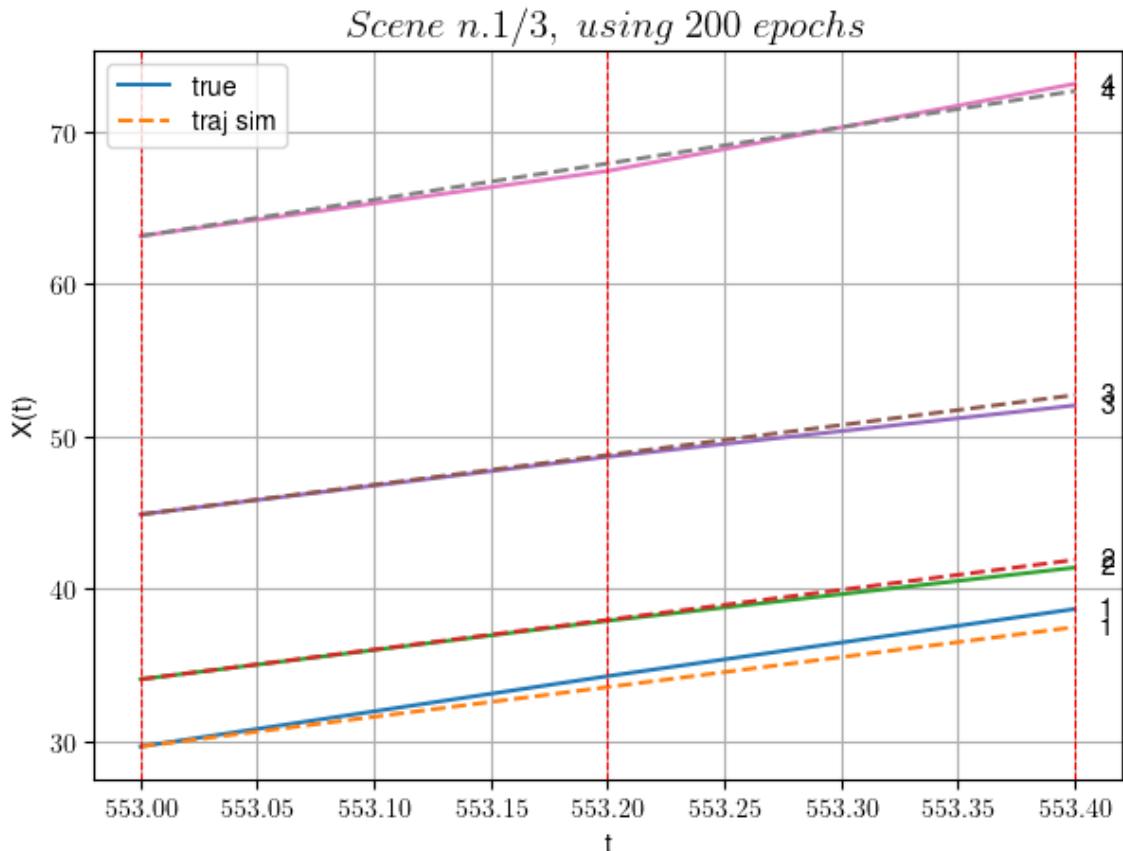
---

---

Scene n.1/3, time interval:[553.00,553.40]

---

---



Loss: 0.2608910317315331  
v0 updated: 23.787330449337816

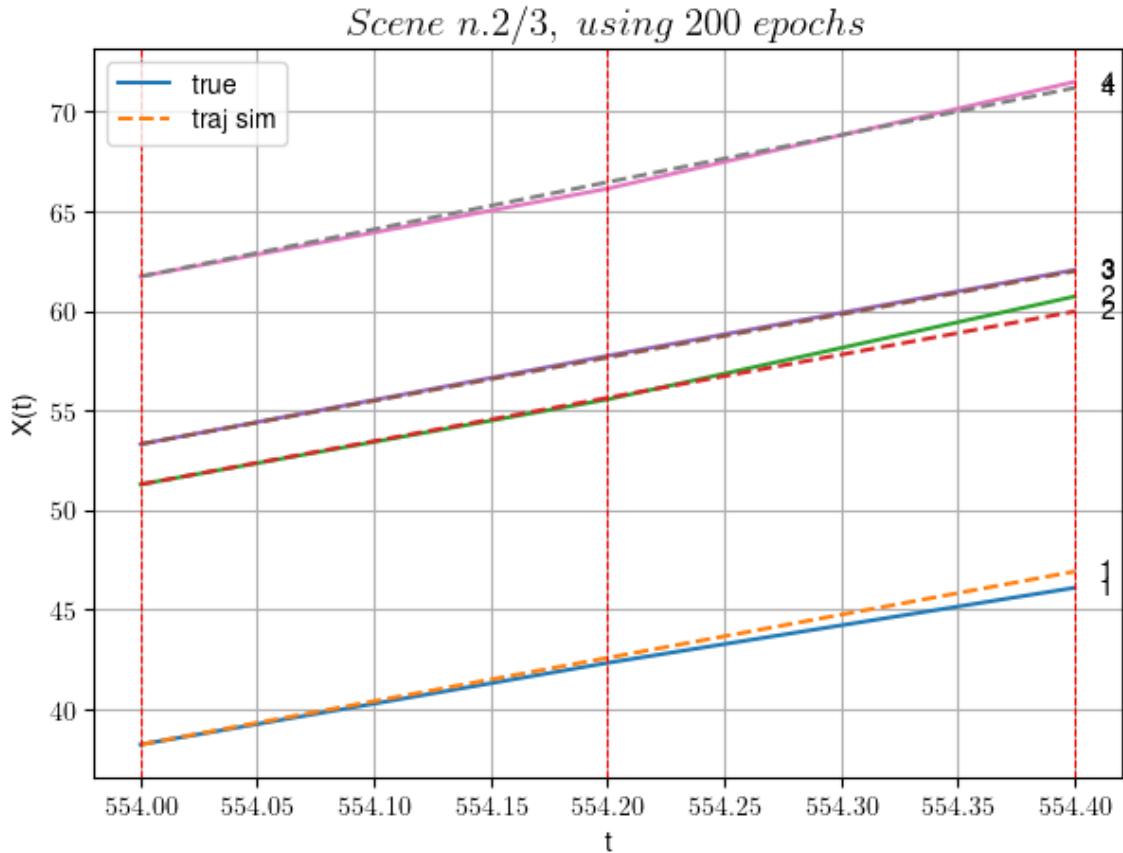
---

---

Scene n.2/3, time interval:[554.00,554.40]

---

---



```
v0_mean in this df is: 23.859329124959213
Time taken: 12.58s
Hidden-Layer-1/kernel:0:      [-1543128.6      -2946.929]
Hidden-Layer-1/bias:0:        [-76481.914     -237.7462]
Output-Layer/kernel:0:        [-1.2088498e+06  -3.2554160e+02]
Output-Layer/bias:0:          [21.762316]
```

---



---

In df n.7/10 we have 8 scenes

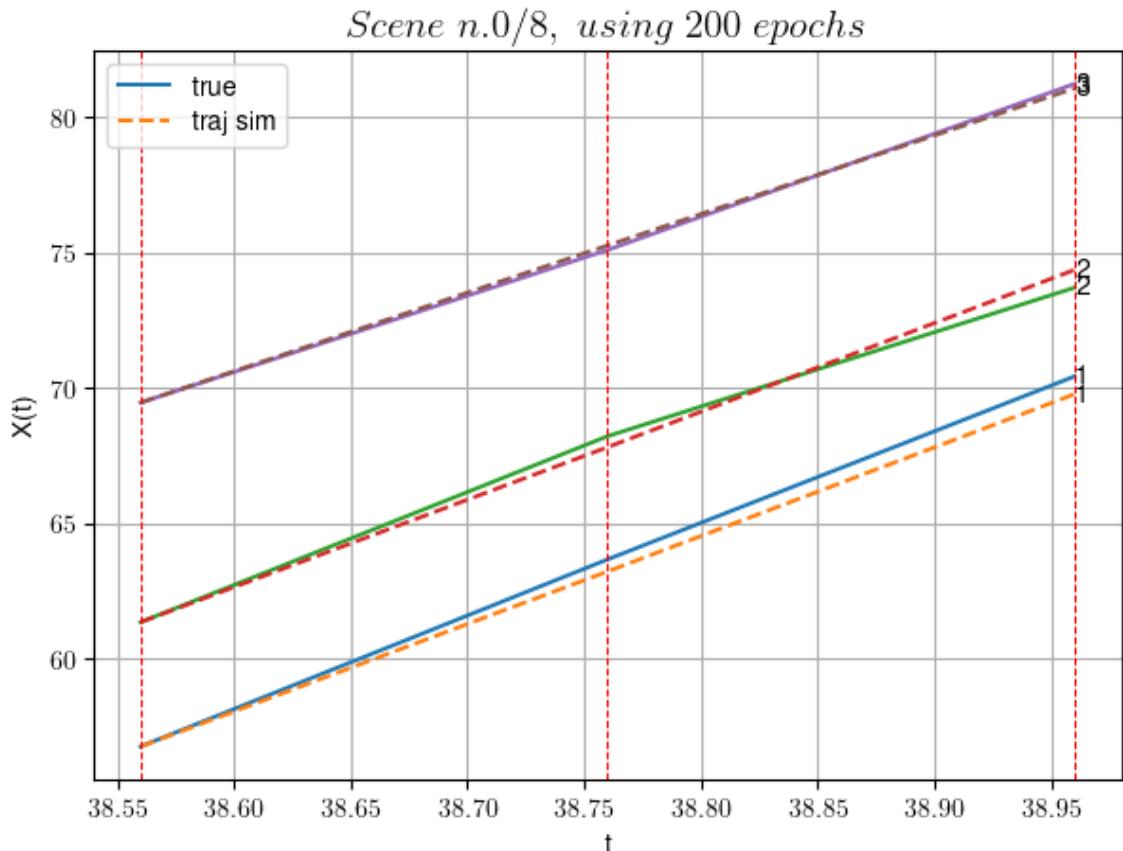
---

Scene n.0/8, time interval:[38.56,38.96]

---



---



Loss: 0.14196907898337394  
v0 updated: 28.991119571901432

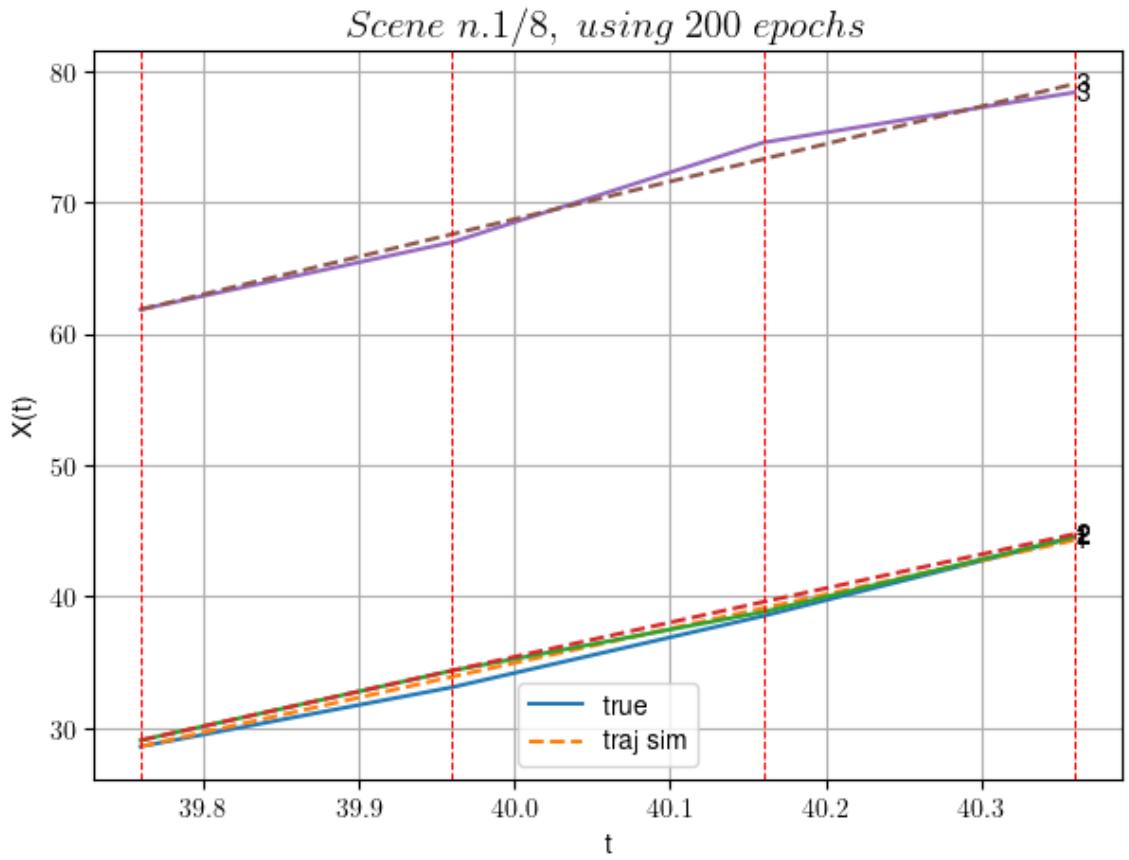
---

---

Scene n.1/8, time interval:[39.76,40.36]

---

---



Loss: 0.3382774836947055  
v0 updated: 28.631257271127794

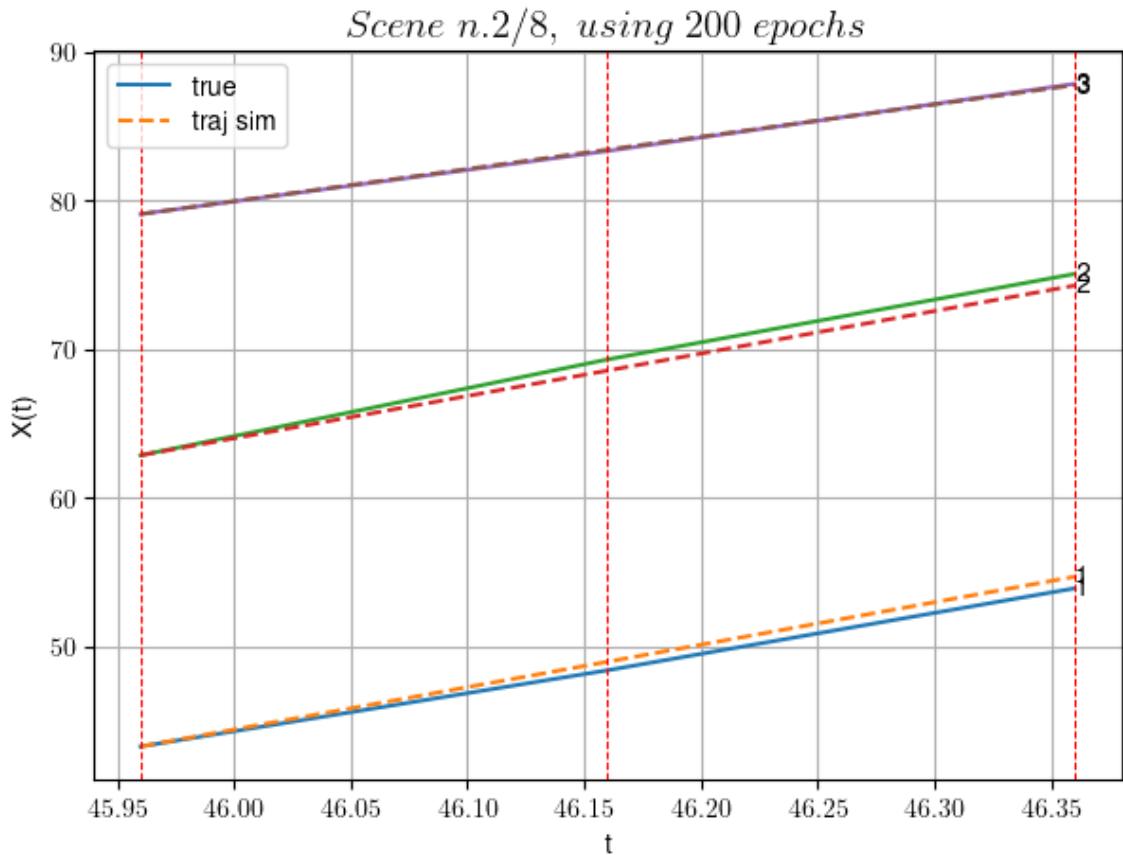
---

---

Scene n.2/8, time interval:[45.96,46.36]

---

---



Loss: 0.2360679258220193  
v0 updated: 21.688502462638503

---

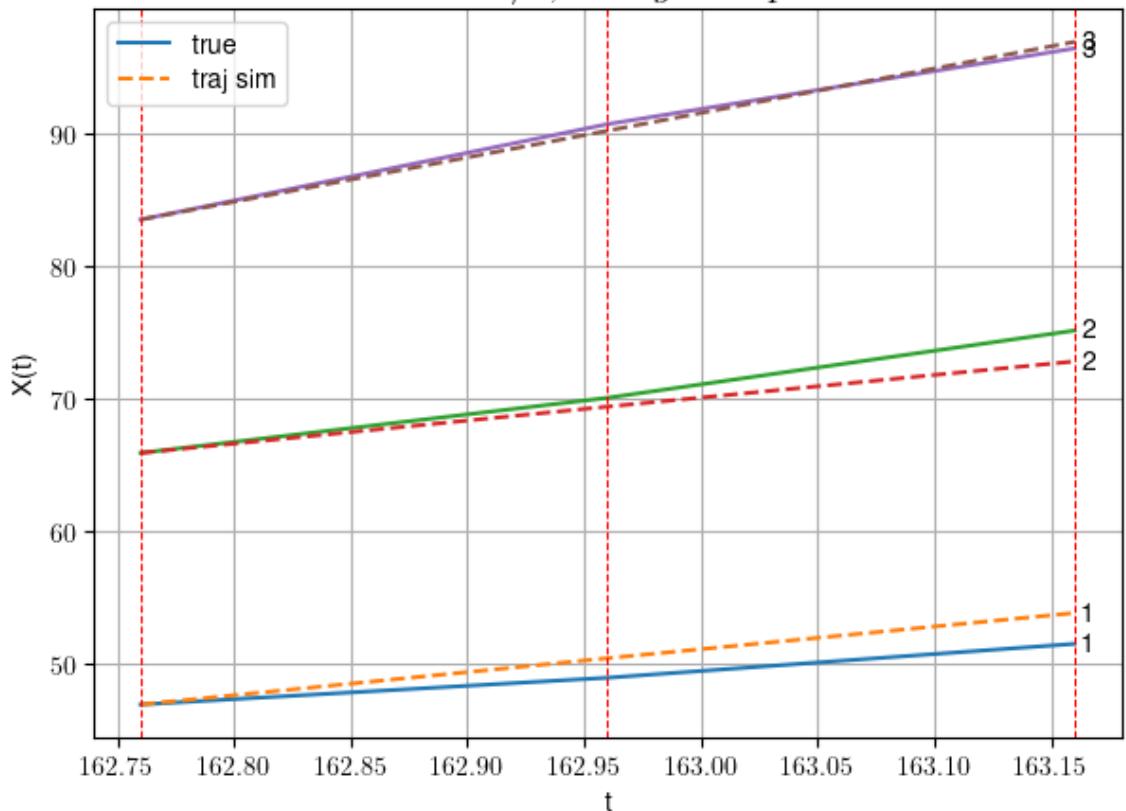
---

Scene n.3/8, time interval:[162.76,163.16]

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---

Scene n.3/8, using 200 epochs

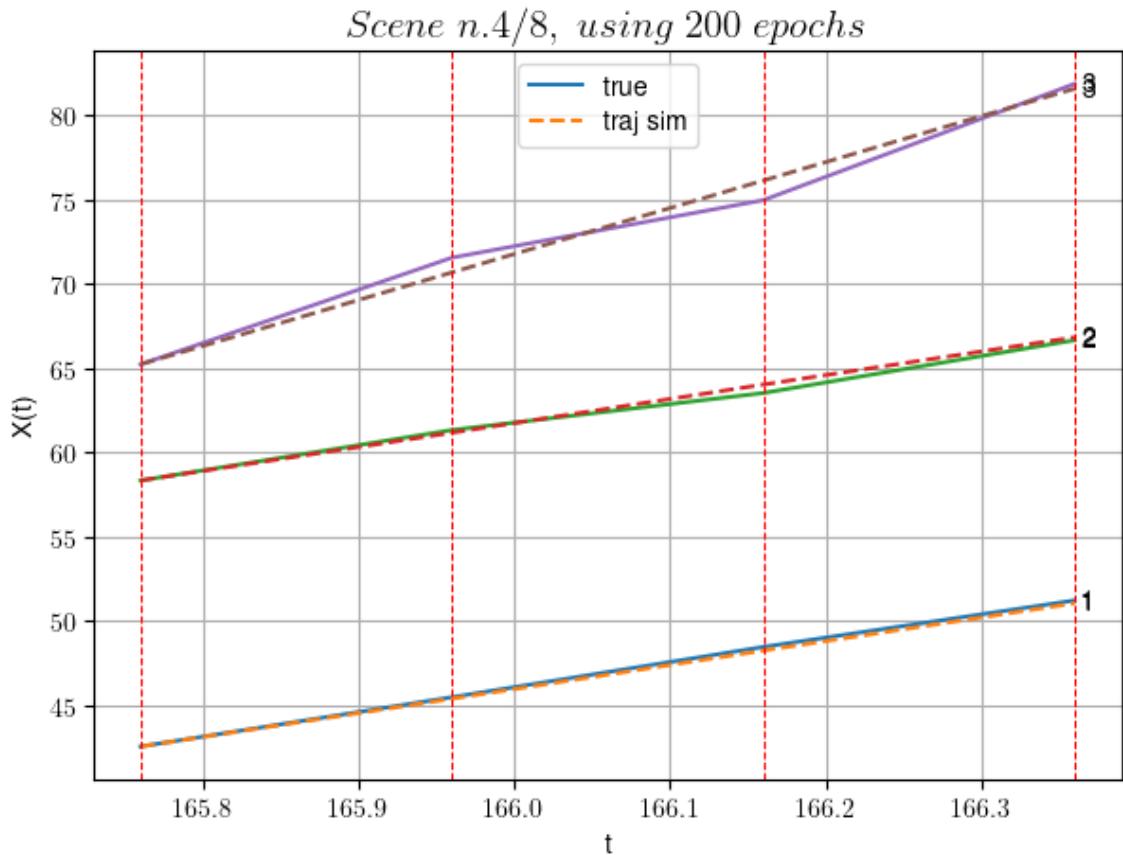


Loss: 1.5490462092889077  
v0 updated: 33.51069558869736

---

Scene n.4/8, time interval:[165.76,166.36]

---



Loss: 0.21631944698967723  
v0 updated: 27.26521595497116

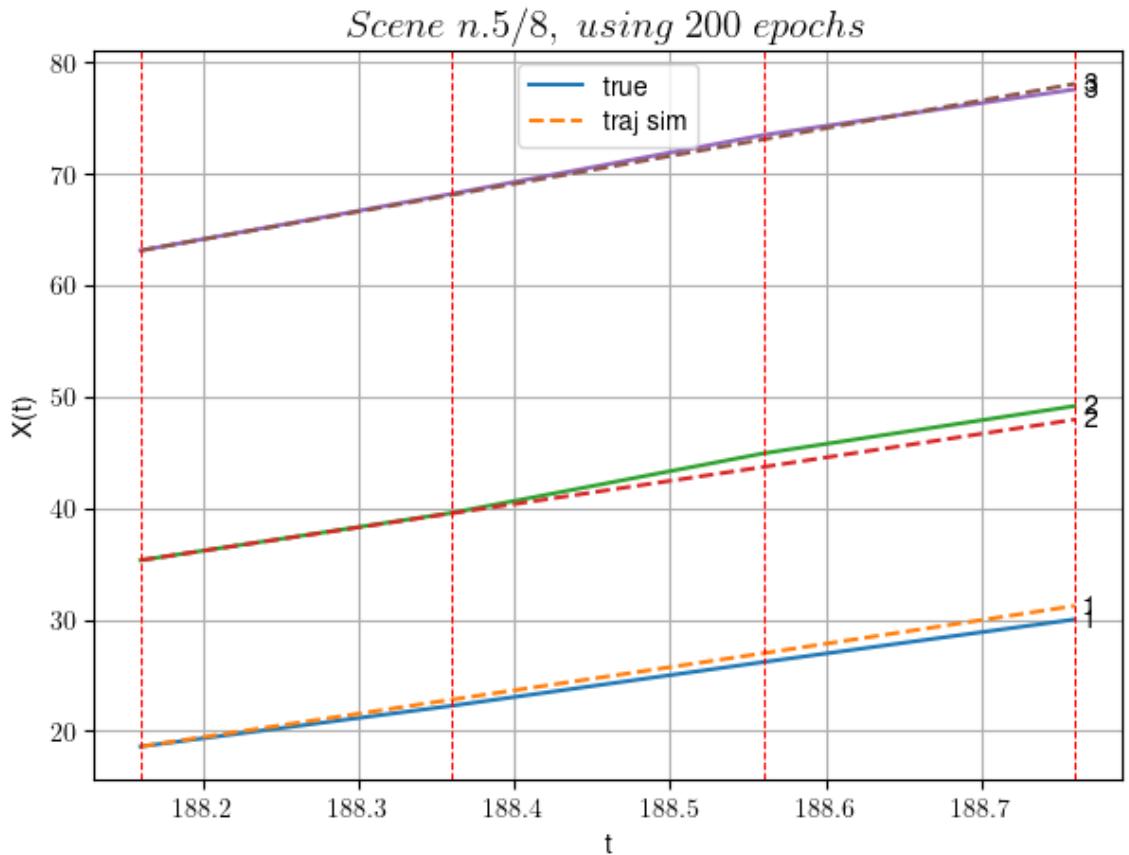
---

---

Scene n.5/8, time interval:[188.16,188.76]

---

---



Loss: 0.48193911725375993  
v0 updated: 24.90420963899612

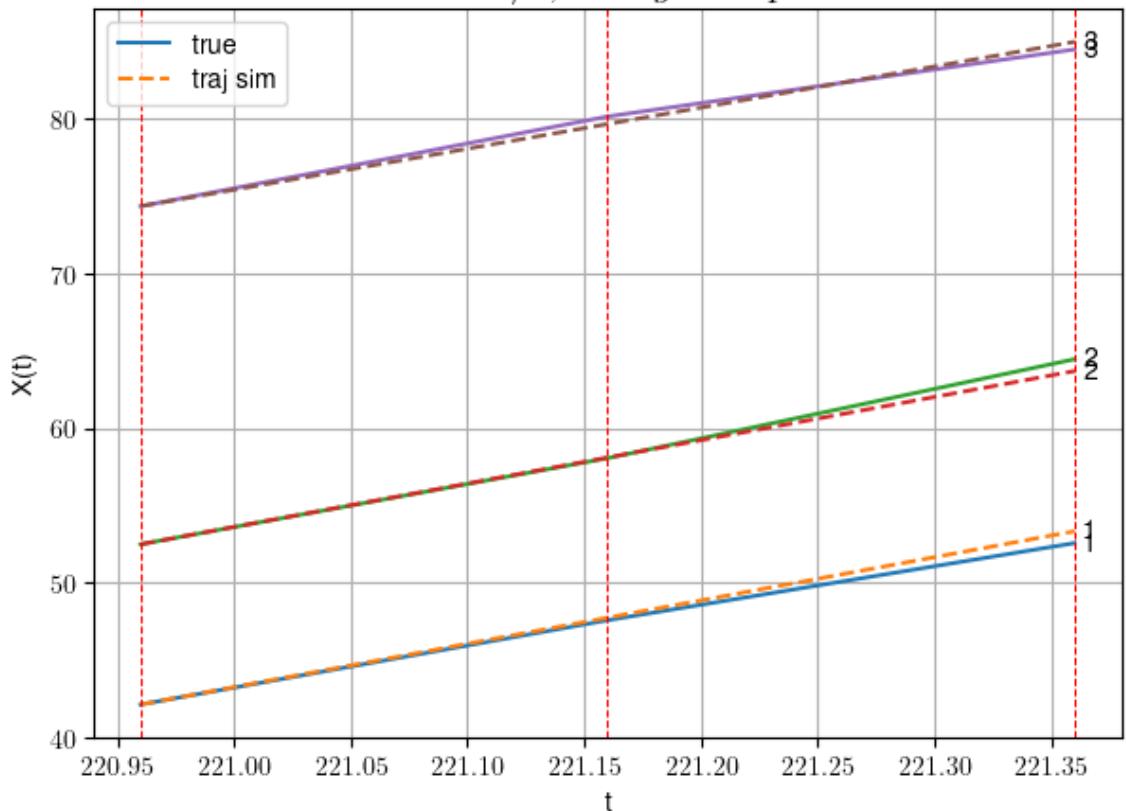
---

---

Scene n.6/8, time interval:[220.96,221.36]

---

---

*Scene n.6/8, using 200 epochs*

Loss: 0.18637988037752853  
v0 updated: 26.583600781325373

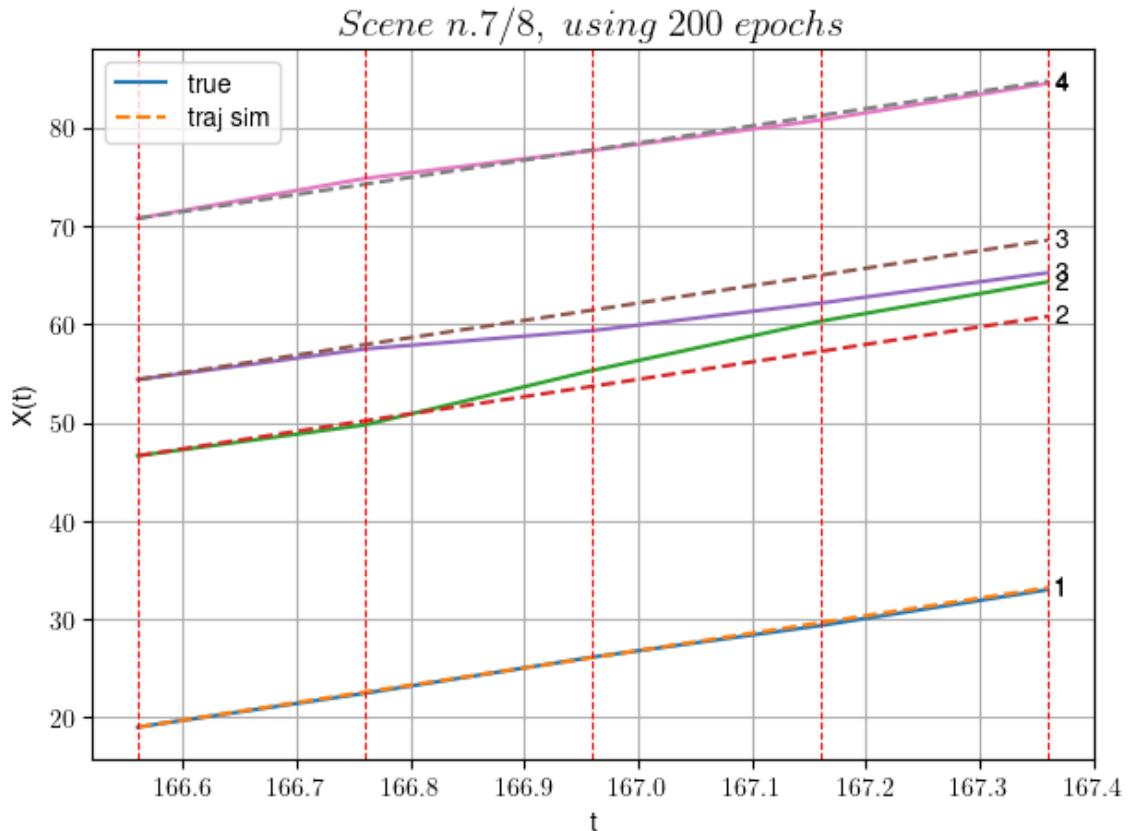
---

---

Scene n.7/8, time interval:[166.56,167.36]

---

---



Loss: 2.447206697686136  
 $v_0$  updated: 17.446466440824256

---



---

$v_0$ \_mean in this df is: 26.771402099536466  
 Time taken: 37.28s  
 Hidden-Layer-1/kernel:0: [-1543128.6 -2946.929]  
 Hidden-Layer-1/bias:0: [-76481.914 -237.7462]  
 Output-Layer/kernel:0: [-1.2088498e+06 -3.2554160e+02]  
 Output-Layer/bias:0: [17.854322]

---



---

In df n.8/10 we have 21 scenes

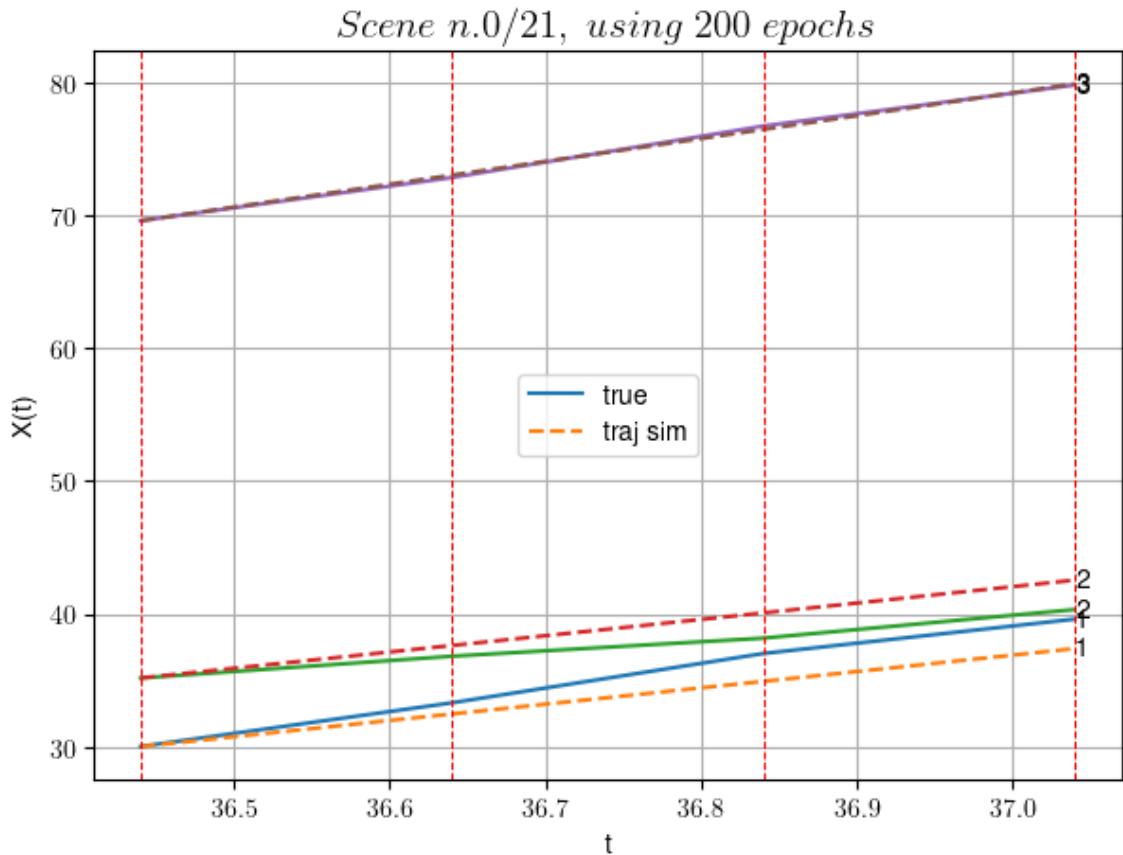
---

Scene n.0/21, time interval:[36.44,37.04]

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---



Loss: 1.607148427712479  
v0 updated: 17.17089794364062

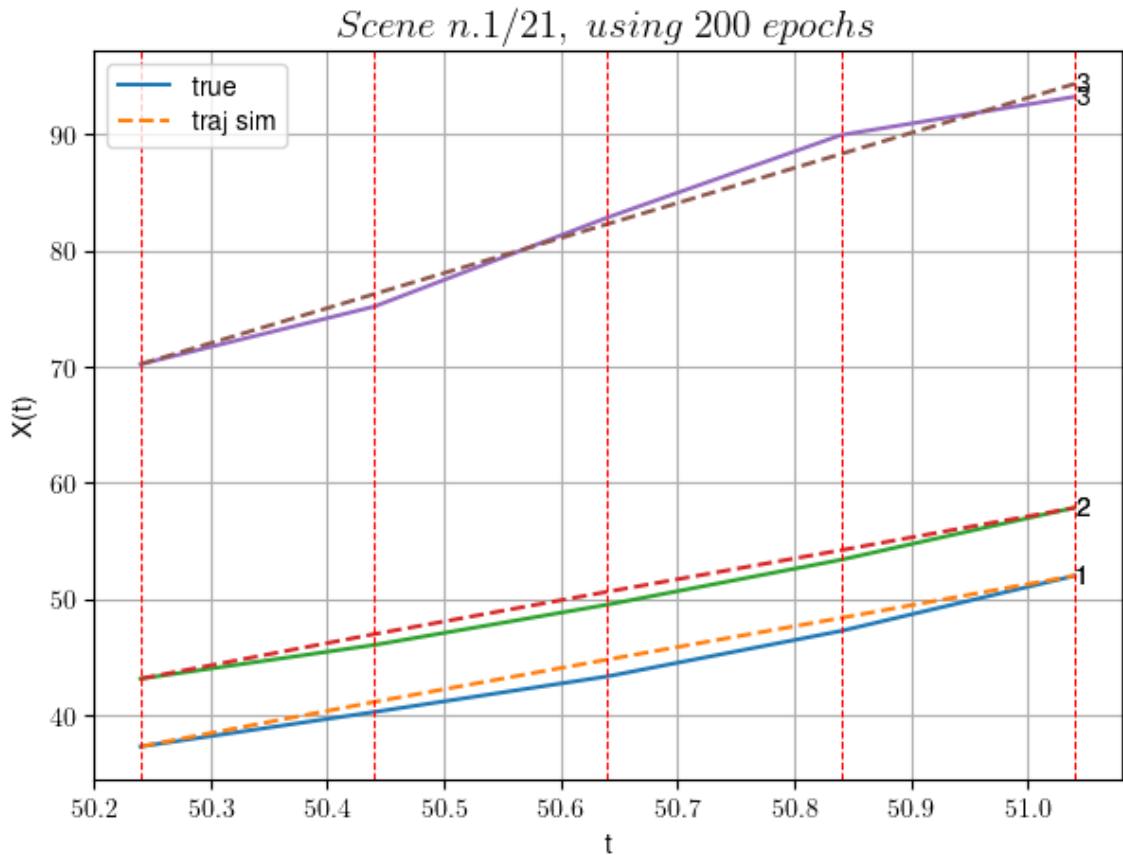
---

---

Scene n.1/21, time interval:[50.24,51.04]

---

---



Loss: 0.8178821959403538  
v0 updated: 30.15748786026172

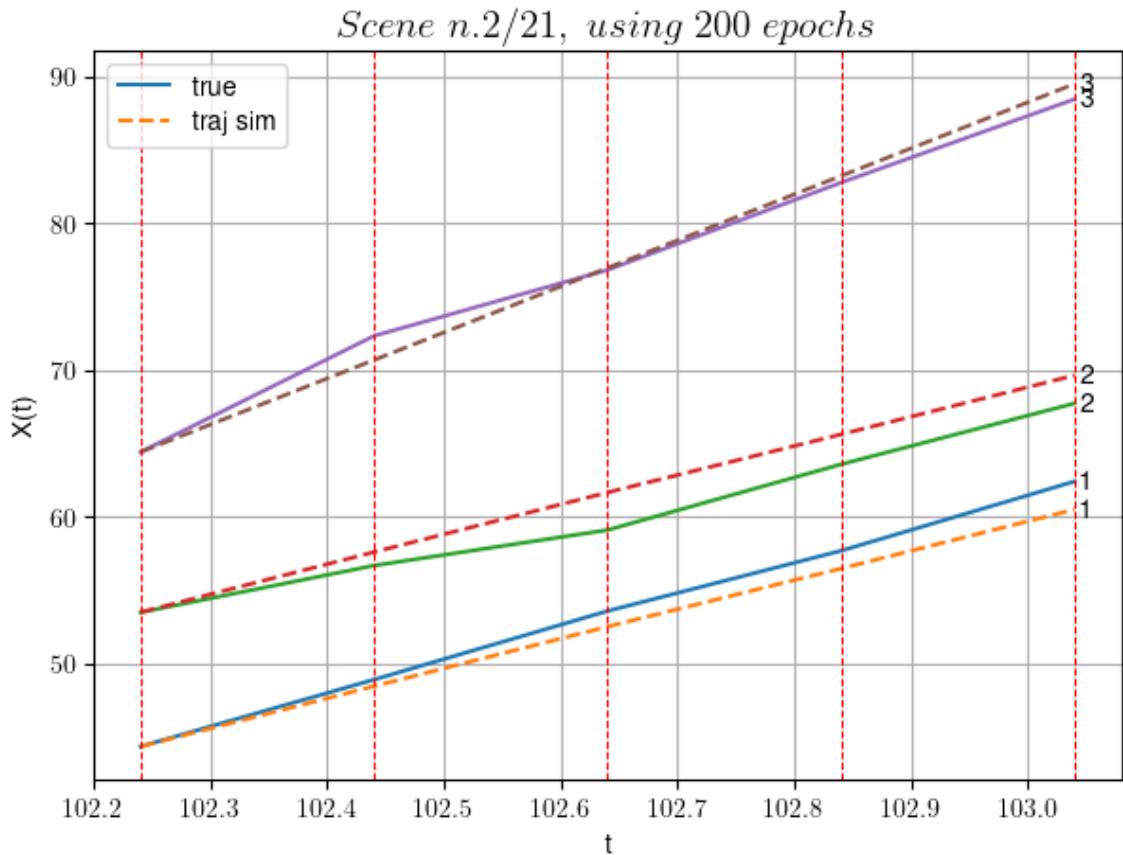
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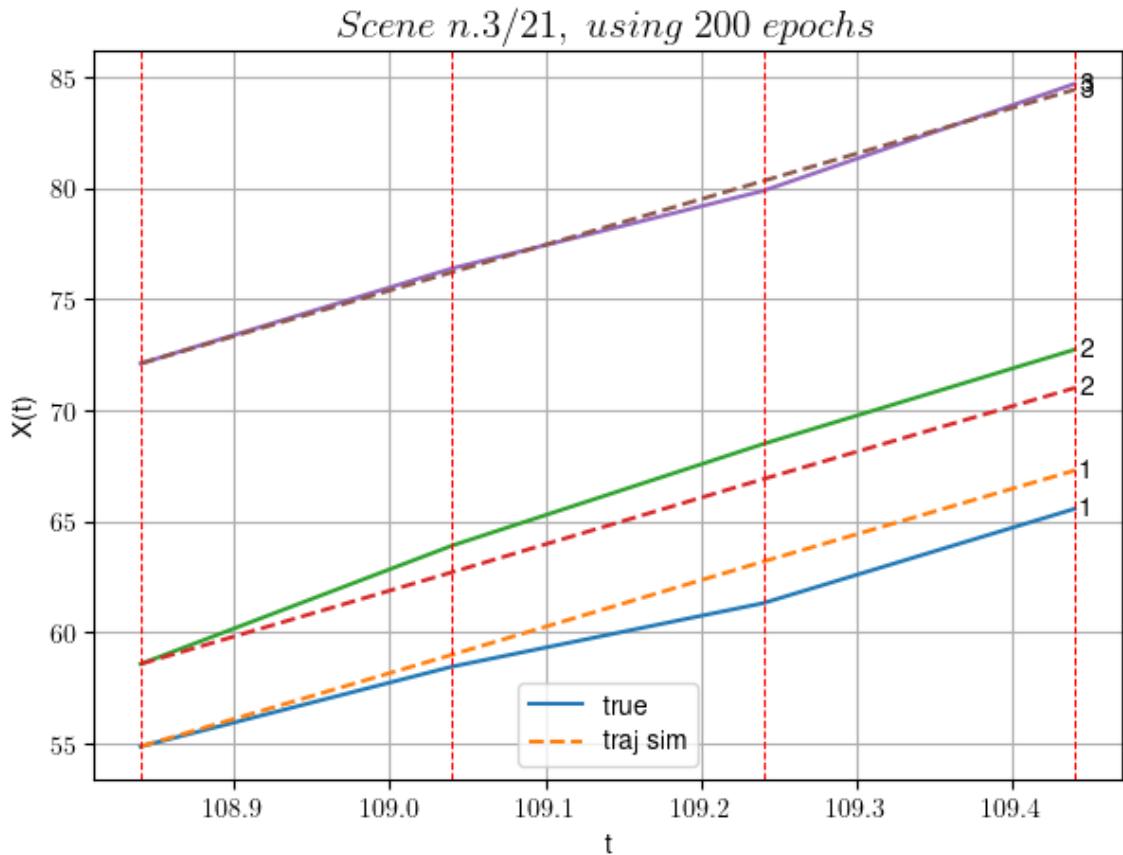
Scene n.2/21, time interval:[102.24,103.04]

---

---



Scene n.3/21, time interval:[108.84,109.44]



Loss: 1.166618330669097  
v0 updated: 20.559392419821574

---

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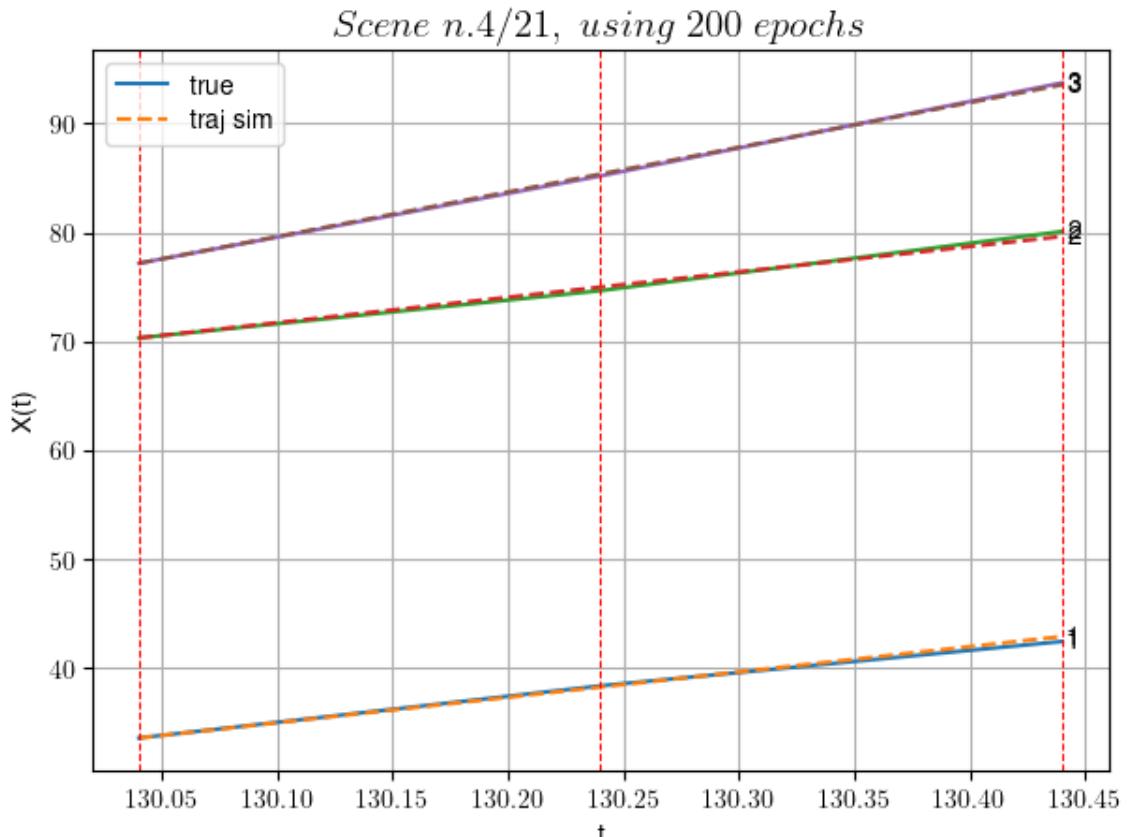
---

Scene n.4/21, time interval:[130.04,130.44]

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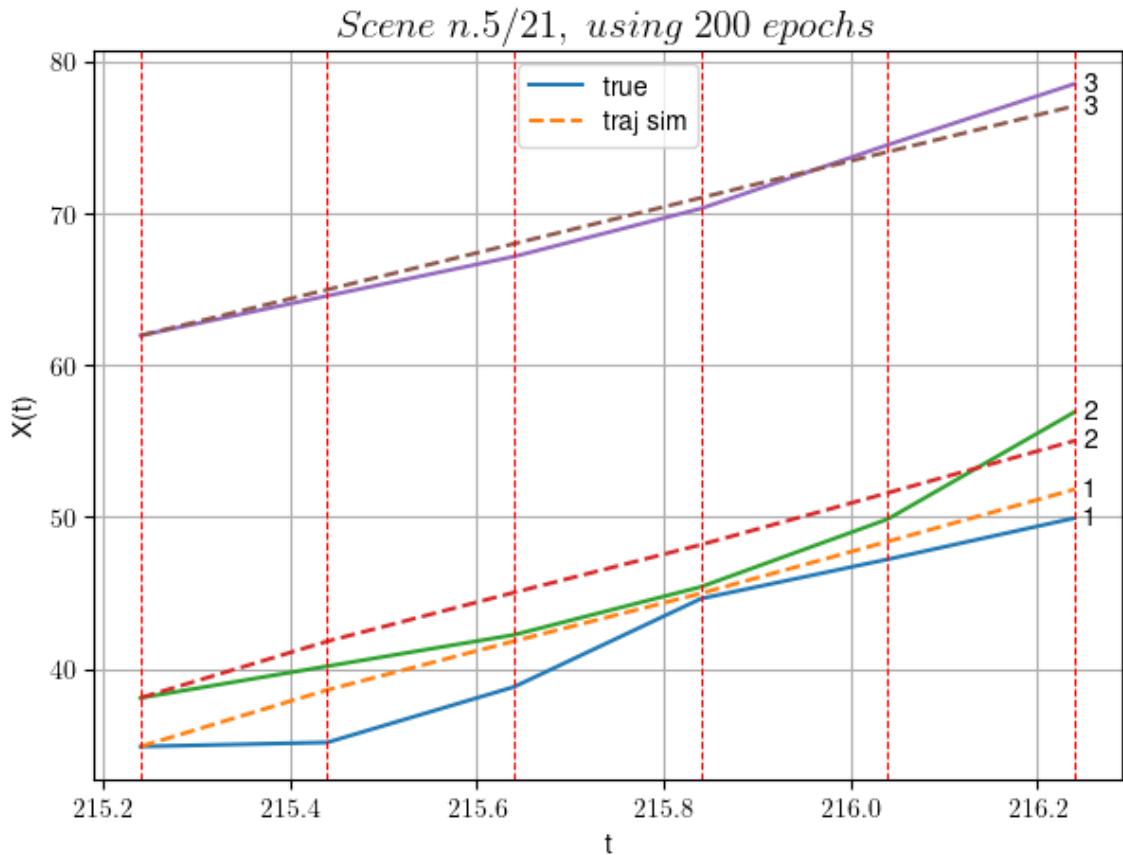


Loss: 0.06782294220729948  
v0 updated: 41.04348308440233

---

Scene n.5/21, time interval:[215.24,216.24]

---



Loss: 3.0258158533139494  
v0 updated: 15.117049251682298

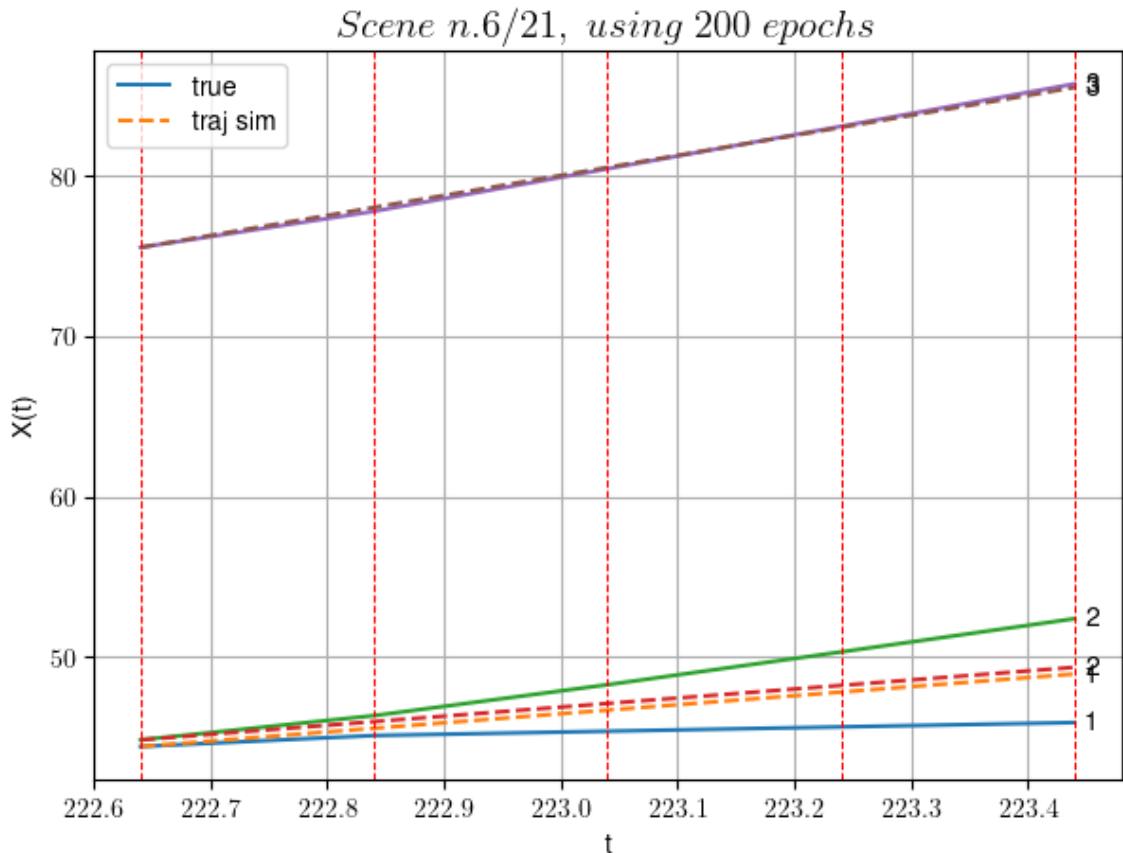
---

---

Scene n.6/21, time interval:[222.64,223.44]

---

---



Loss: 2.0598211337228944  
v0 updated: 12.44783182194636

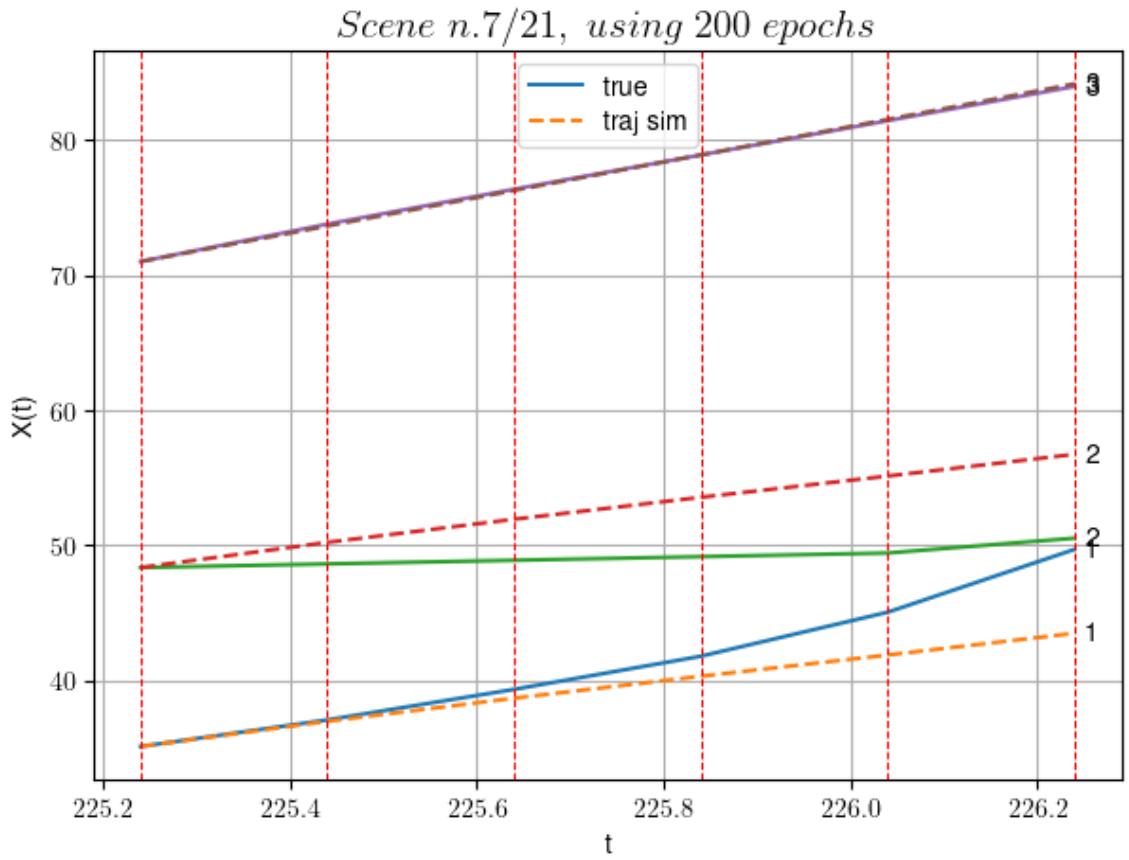
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---

Scene n.7/21, time interval:[225.24,226.24]

---

---



Loss: 8.527268656929602  
v0 updated: 13.162191858706763

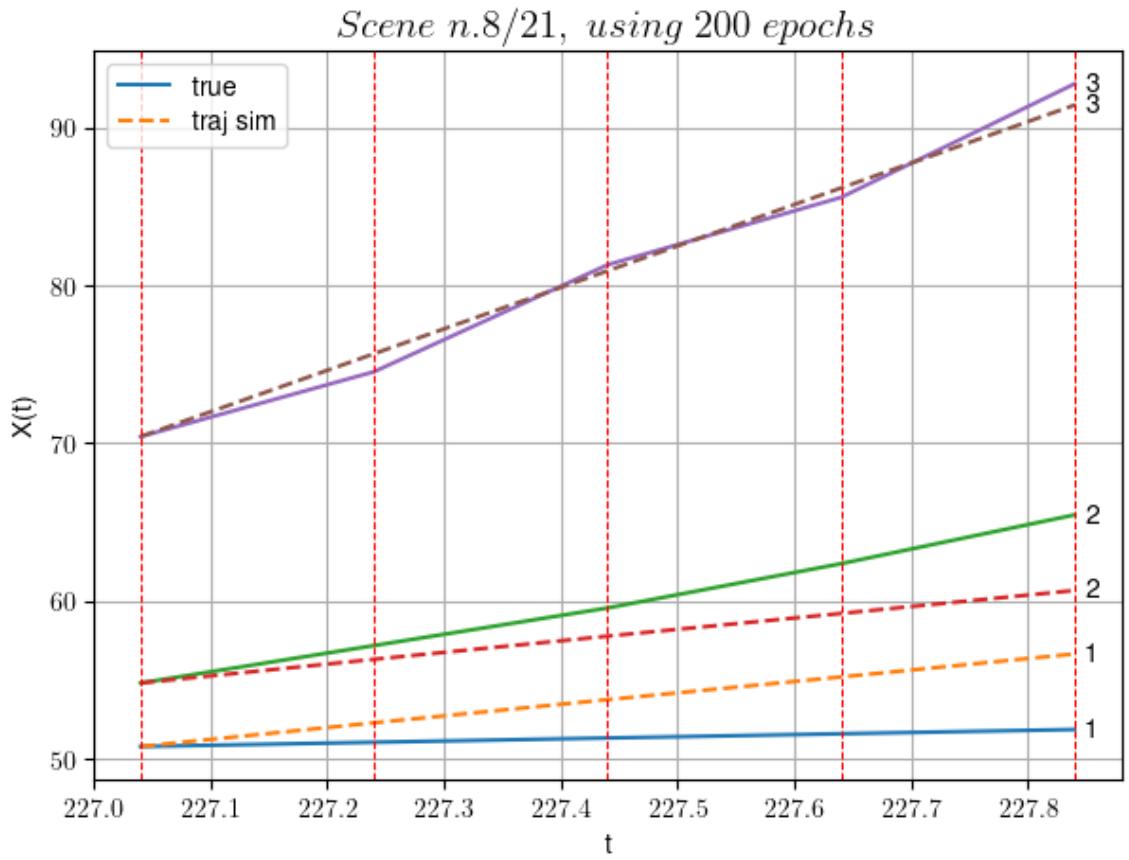
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---

Scene n.8/21, time interval:[227.04,227.84]

---

---



Loss: 5.577761819347756  
v0 updated: 26.247280530693132

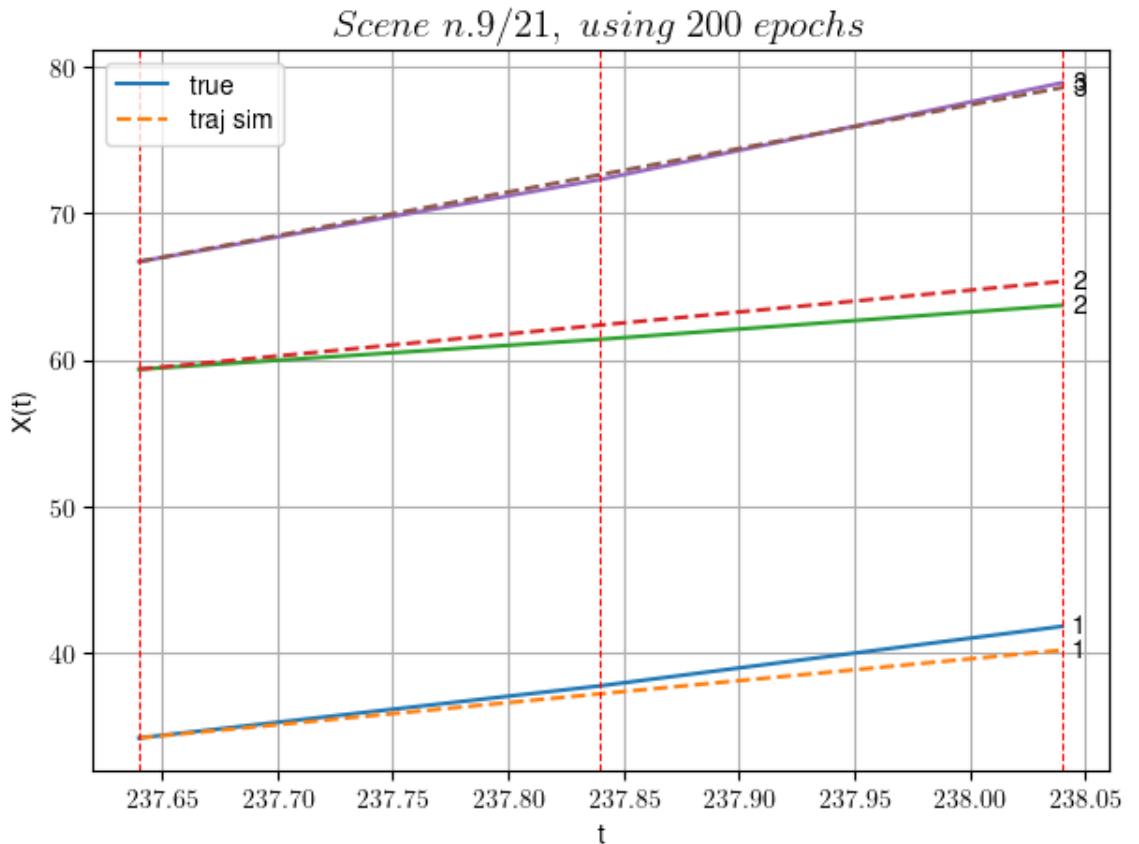
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Scene n.9/21, time interval:[237.64,238.04]

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---



Loss: 0.7498044822730331  
v0 updated: 29.70329363802171

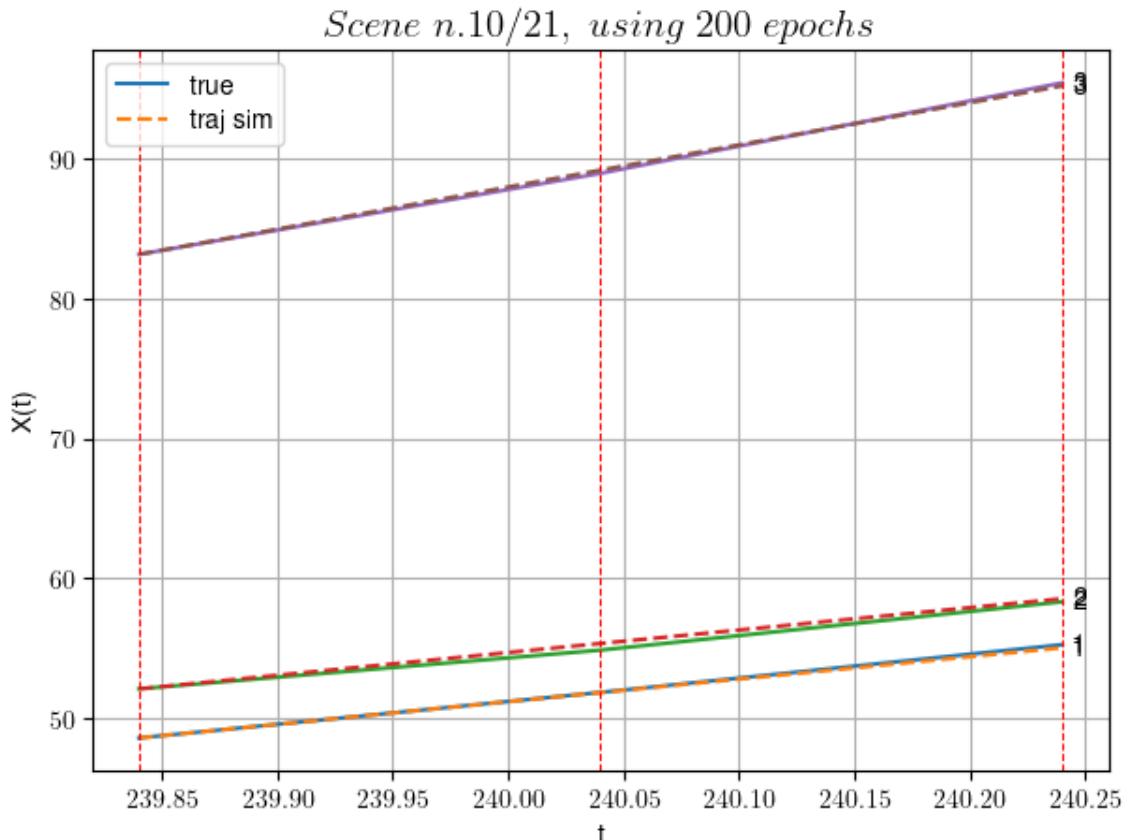
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Scene n.10/21, time interval:[239.84,240.24]

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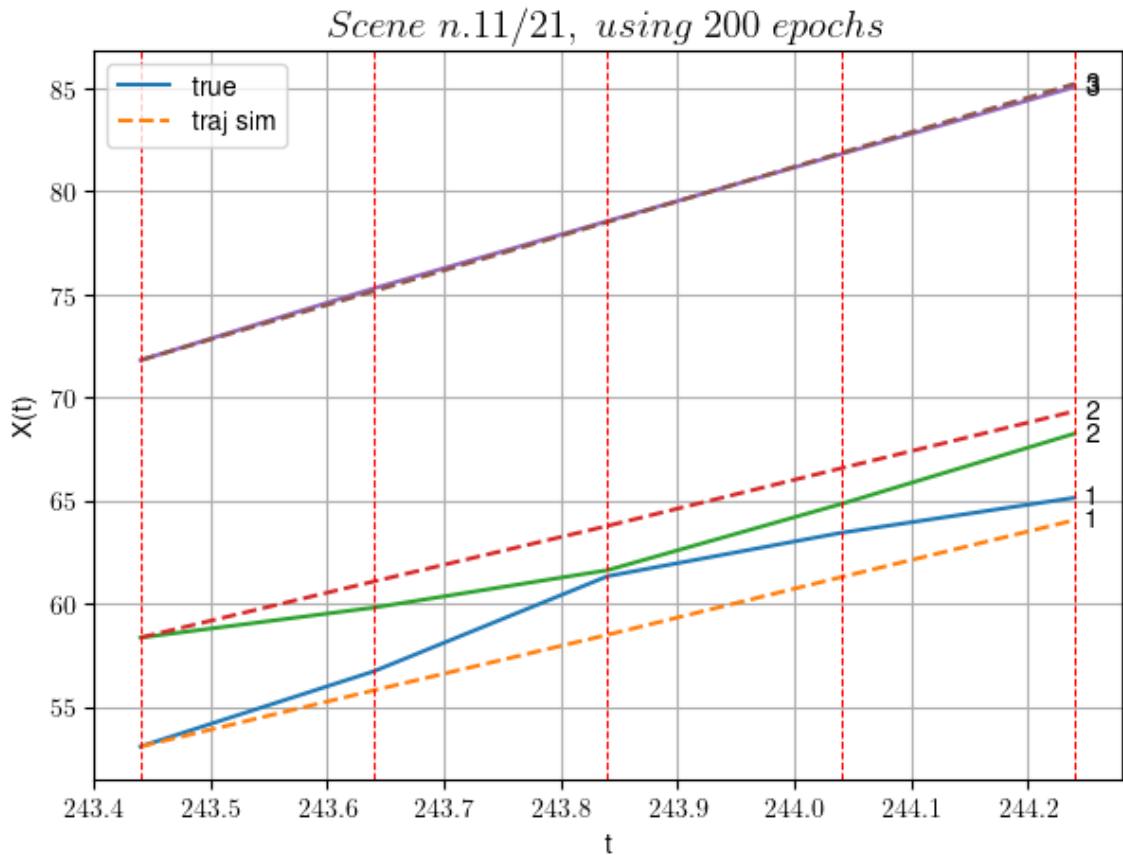


Loss: 0.047612652223725134  
v0 updated: 30.13109543583857

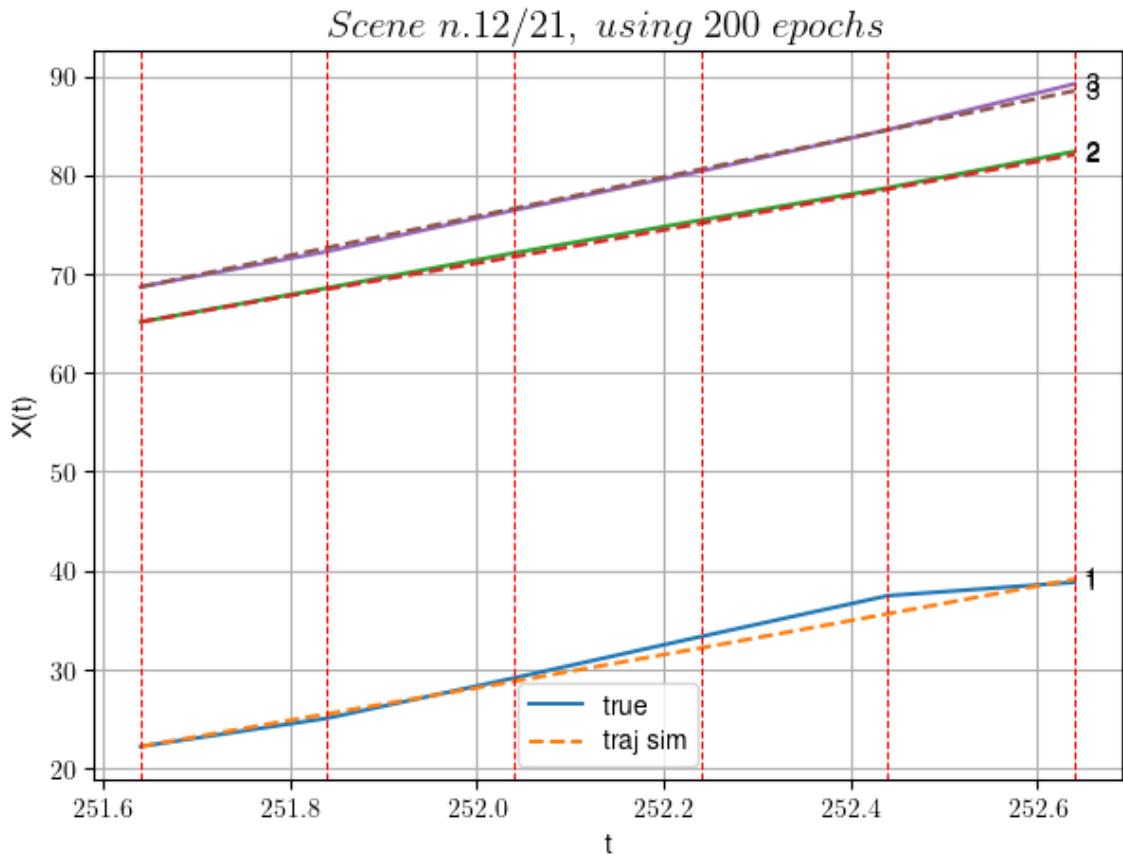
---

Scene n.11/21, time interval:[243.44,244.24]

---



Scene n.12/21, time interval:[251.64,252.64]



Loss: 0.34468700930210056  
v0 updated: 19.83607847657935

---

---

Scene n.13/21, time interval:[290.84,291.44]

---

---



Loss: 3.3398397193157607  
v0 updated: 25.383319029072275

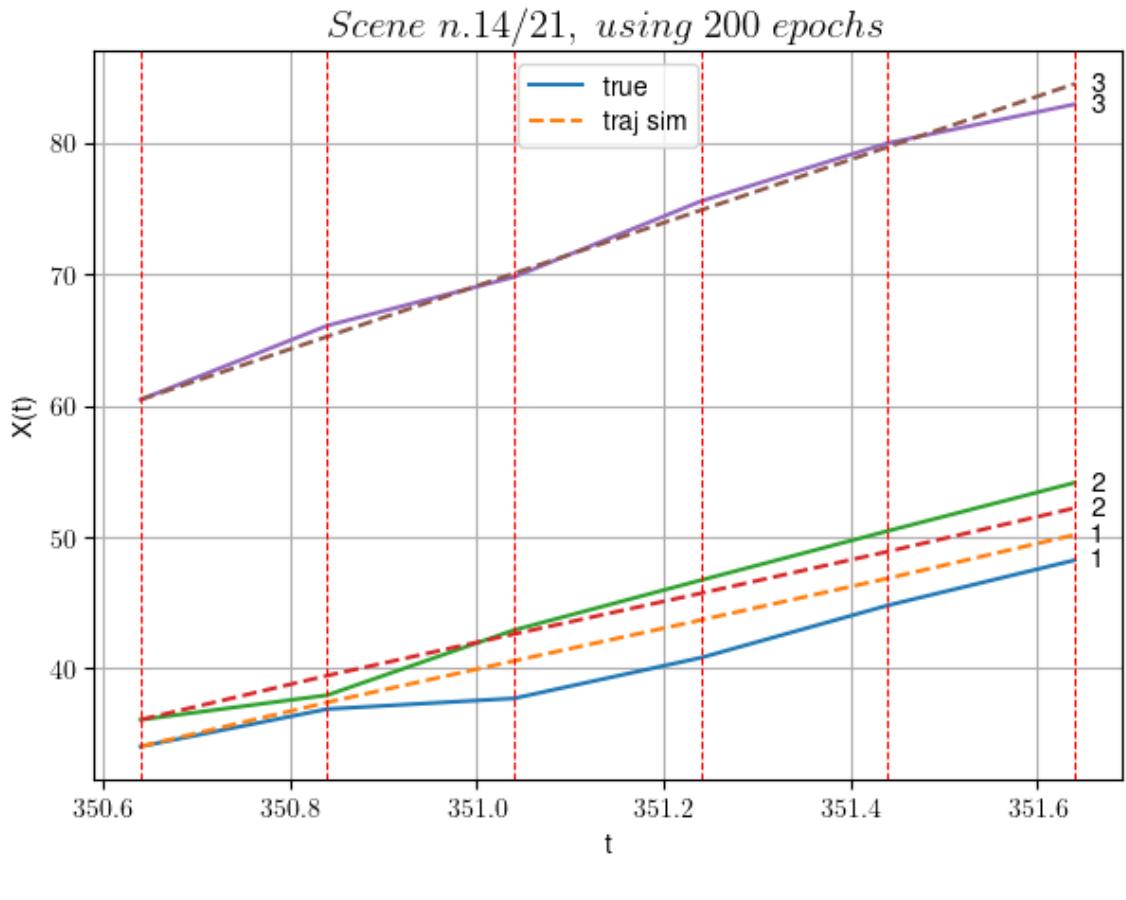
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Scene n.14/21, time interval:[350.64,351.64]

---

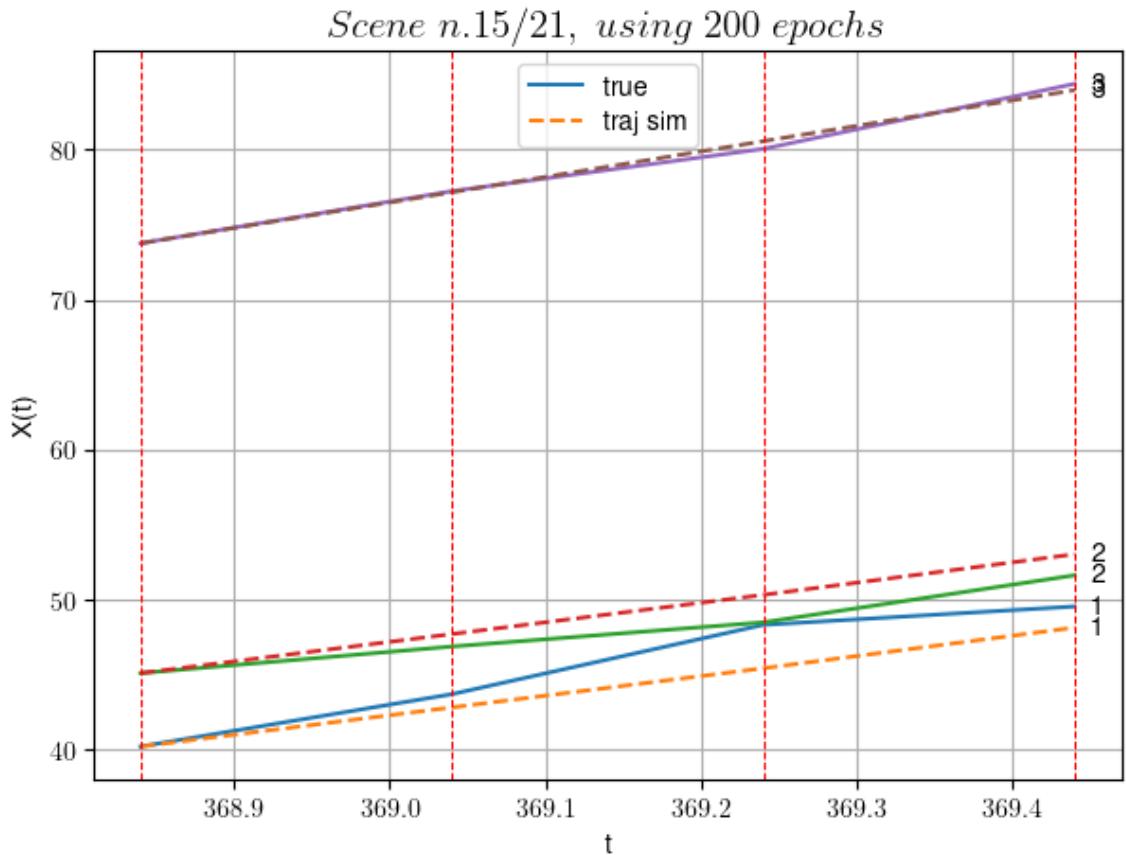
---



---

Scene n.15/21, time interval:[368.84,369.44]

---



Loss: 1.4679548640383062  
v0 updated: 17.02627298452746

---

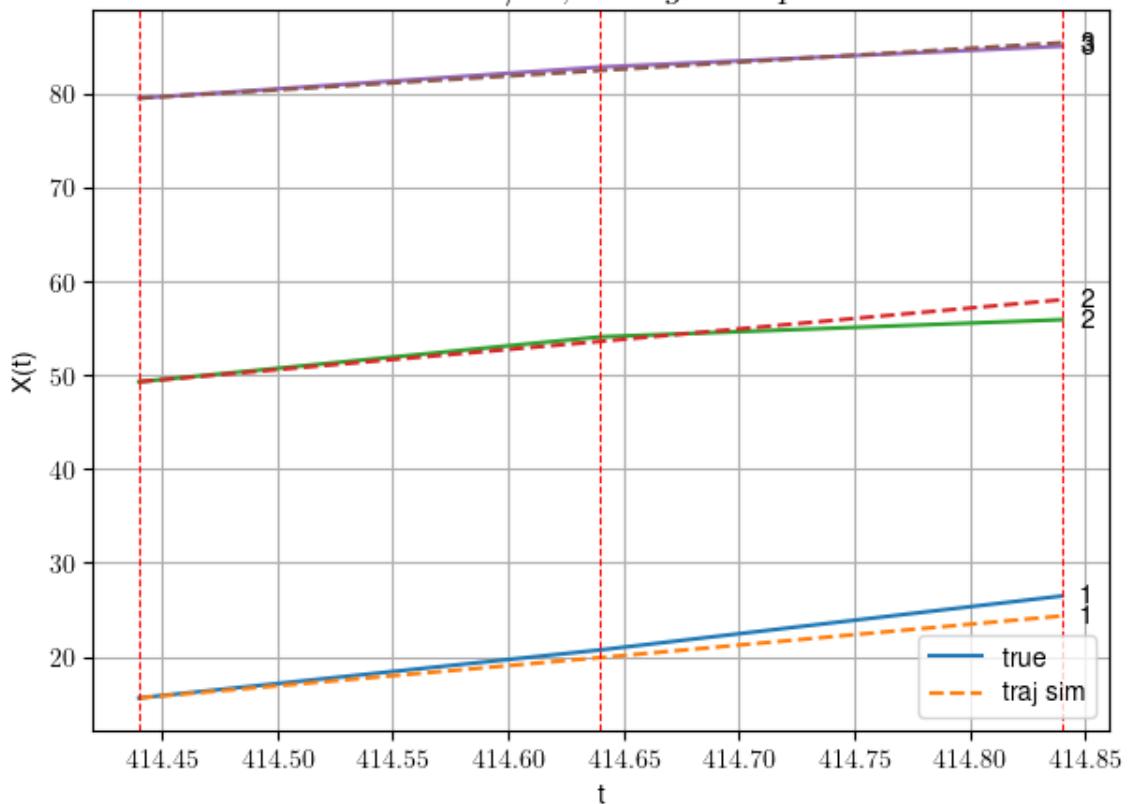
---

Scene n.16/21, time interval:[414.44,414.84]

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---

Scene n.16/21, using 200 epochs

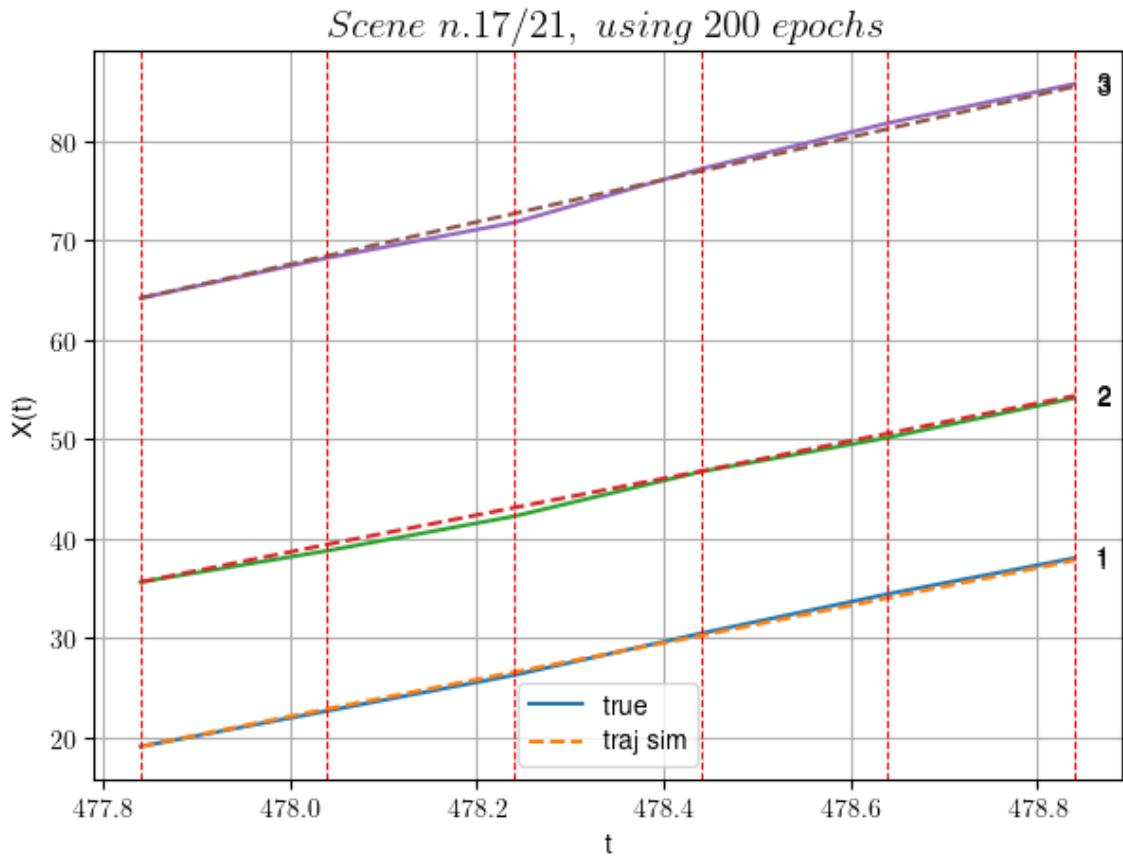


Loss: 1.1329696394391984  
v0 updated: 14.756984069681192

---

Scene n.17/21, time interval:[477.84,478.84]

---



Loss: 0.17282027767774696  
v0 updated: 21.27774697949253

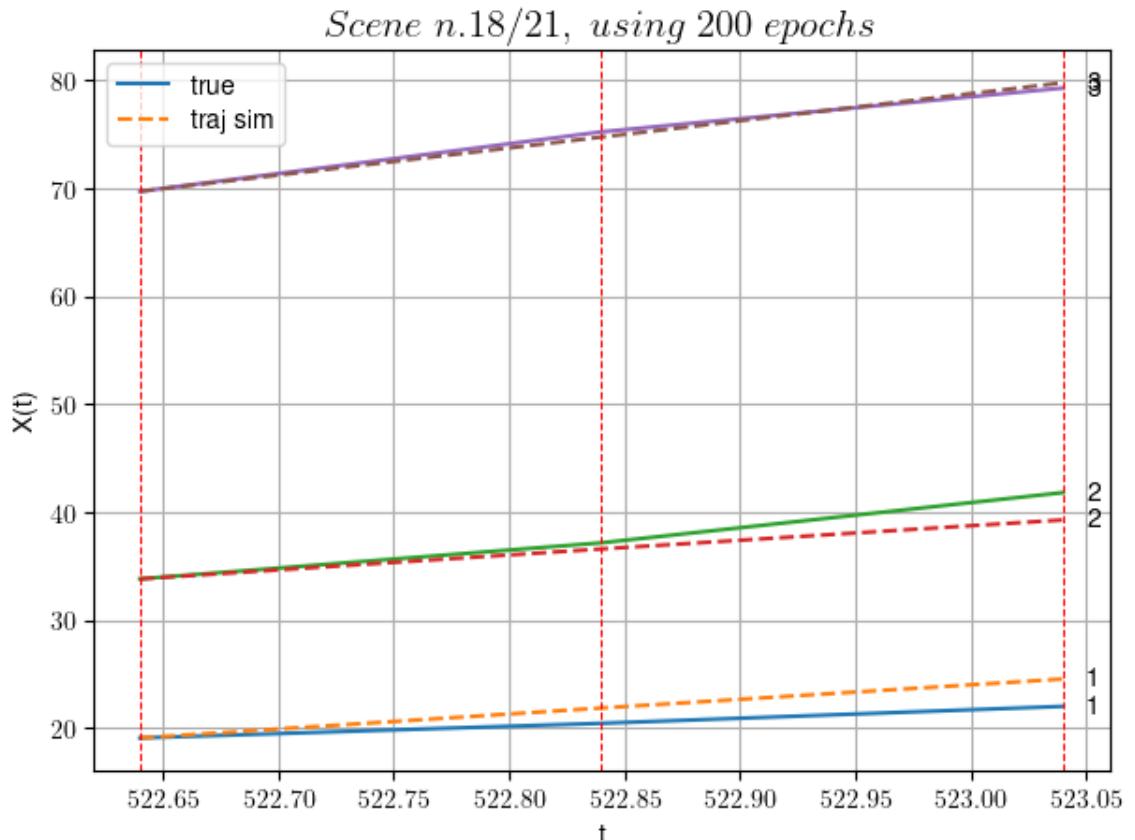
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---

Scene n.18/21, time interval:[522.64,523.04]

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---



Loss: 1.7405329270150158  
v0 updated: 25.161291688856604

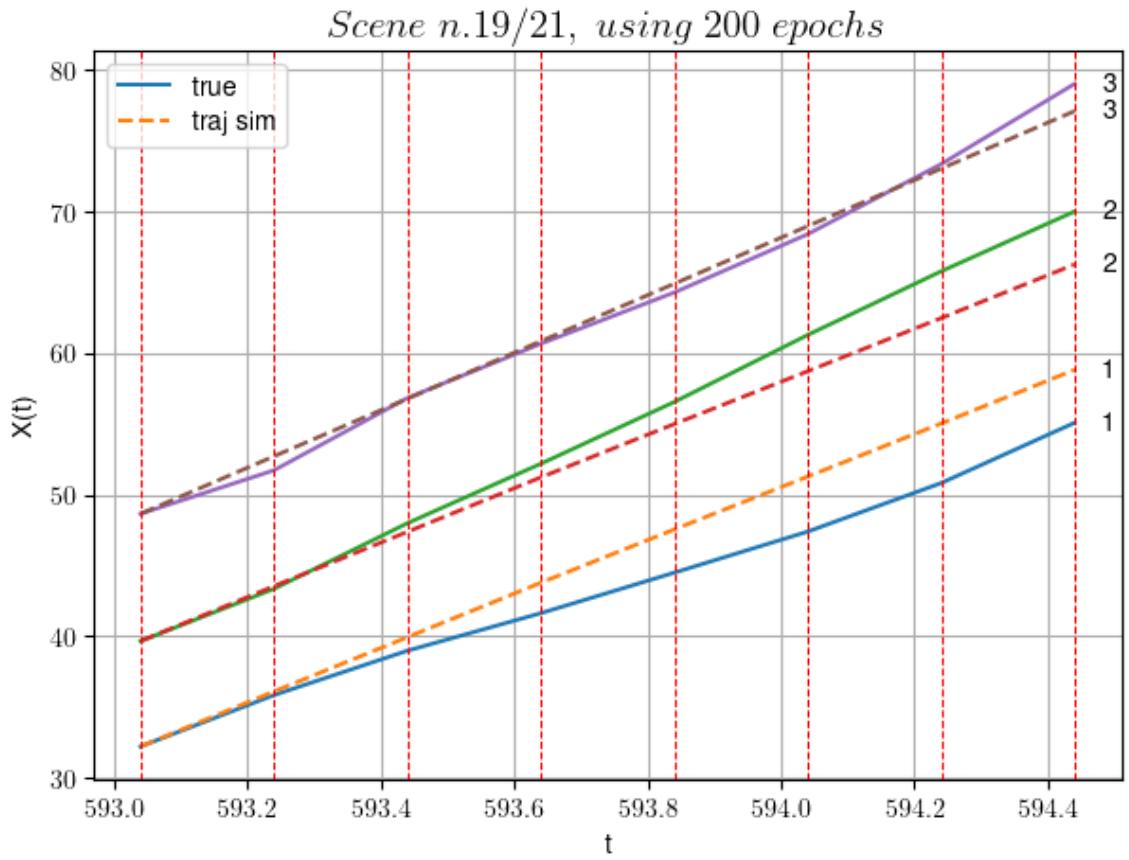
---

---

Scene n.19/21, time interval:[593.04,594.44]

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---



Loss: 4.266746782735732  
v0 updated: 20.308489153886587

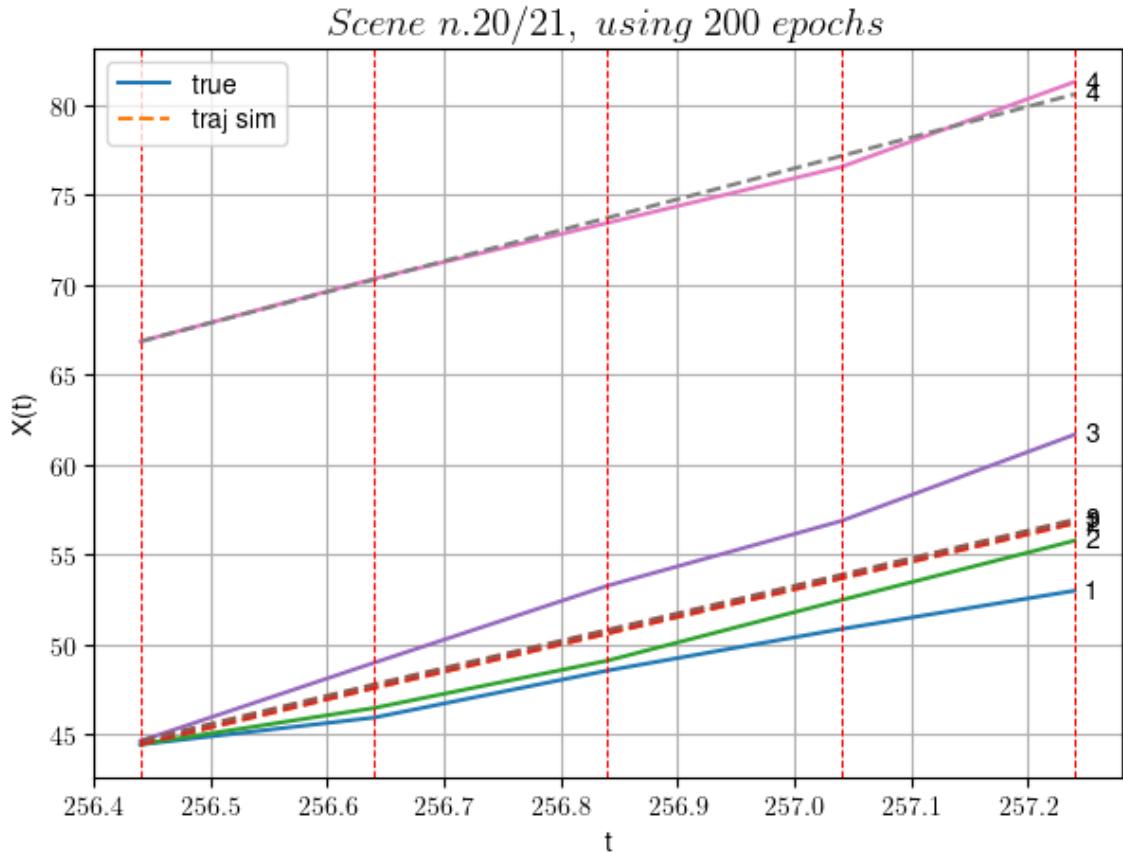
---

---

Scene n.20/21, time interval:[256.44,257.24]

---

---



Loss: 3.735791703701848  
 $v\theta$  updated: 17.183718155732137

---



---

$v\theta$  mean in this df is: 23.488413422860873  
 Time taken: 120.19s  
 Hidden-Layer-1/kernel:0: [-1543128.6 -2946.929]  
 Hidden-Layer-1/bias:0: [-76481.914 -237.7462]  
 Output-Layer/kernel:0: [-1.2088498e+06 -3.2554160e+02]  
 Output-Layer/bias:0: [15.689068]

---



---

In df n.9/10 we have 9 scenes

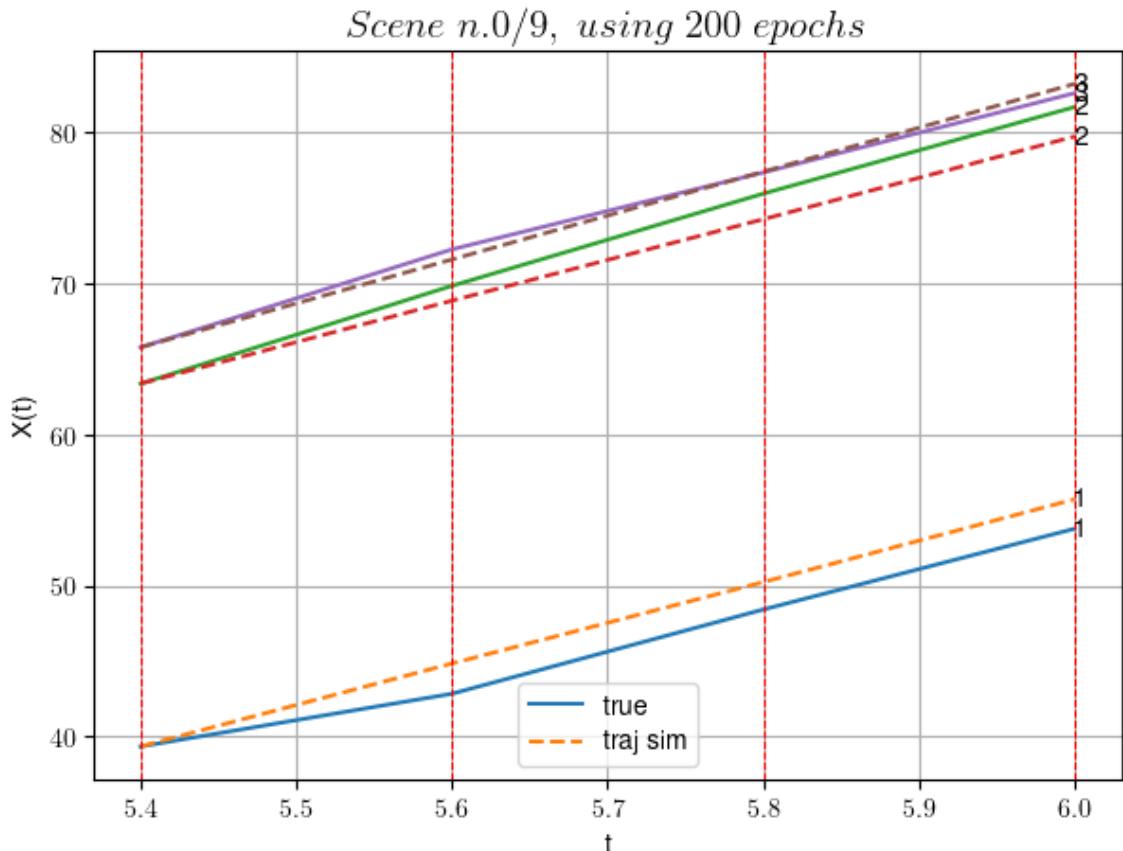
---

Scene n.0/9, time interval:[5.40,6.00]

---



---



Loss: 1.6310264136839192  
v0 updated: 29.082116036814494

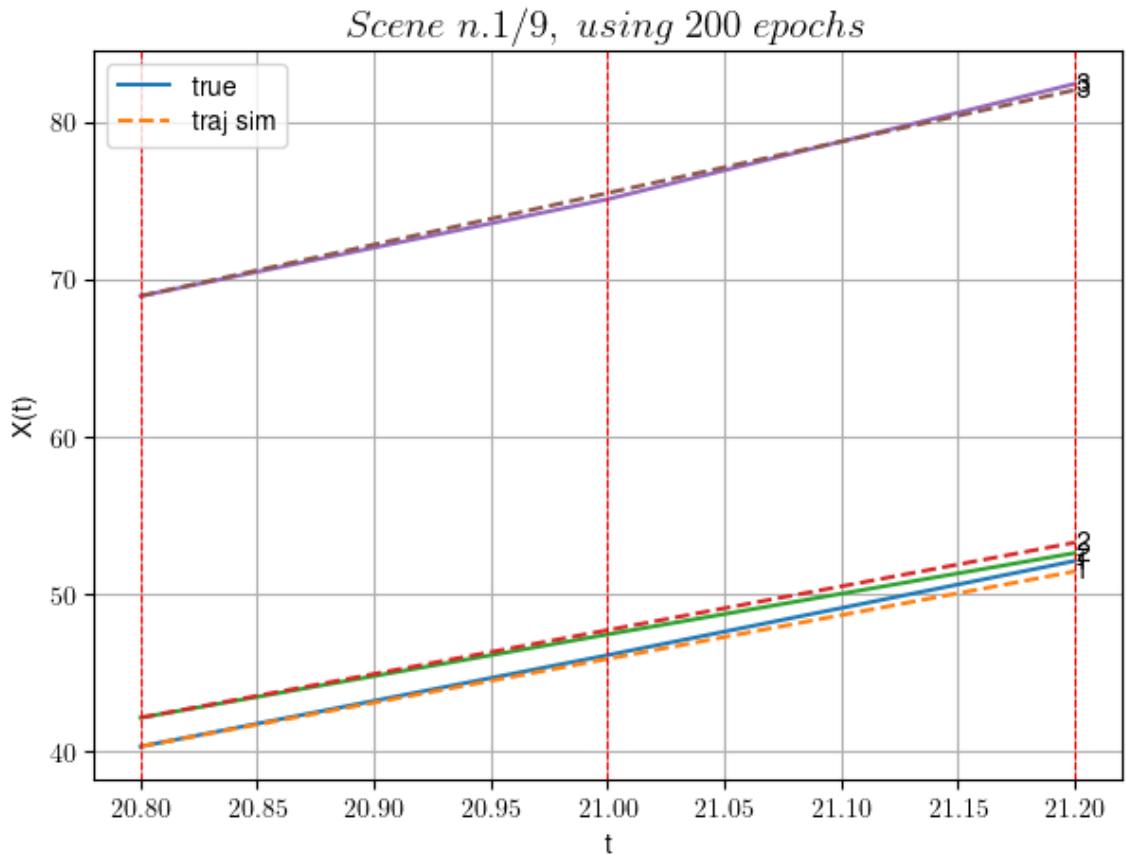
---

---

Scene n.1/9, time interval:[20.80,21.20]

---

---



Loss: 0.14726343881824253  
v0 updated: 32.73031035947344

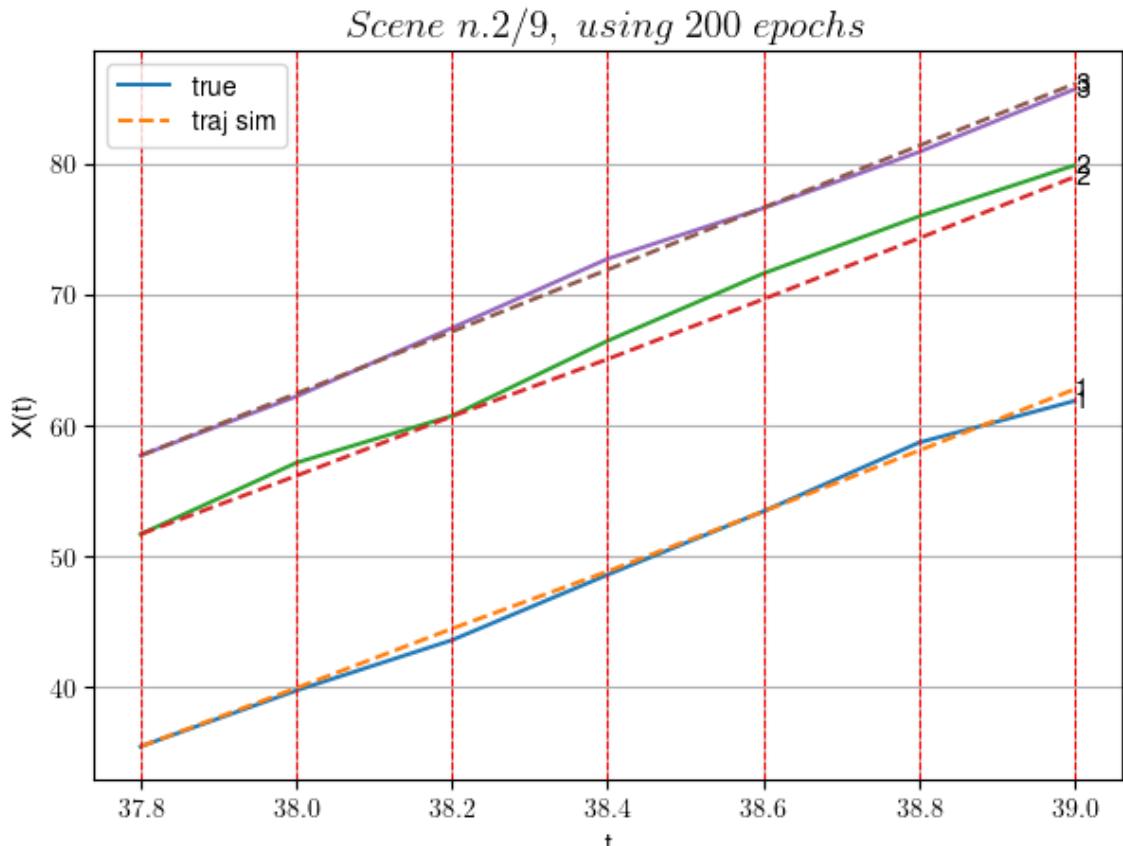
---

---

Scene n.2/9, time interval:[37.80,39.00]

---

---



Loss: 0.6485391571150407  
v0 updated: 23.646035475894625

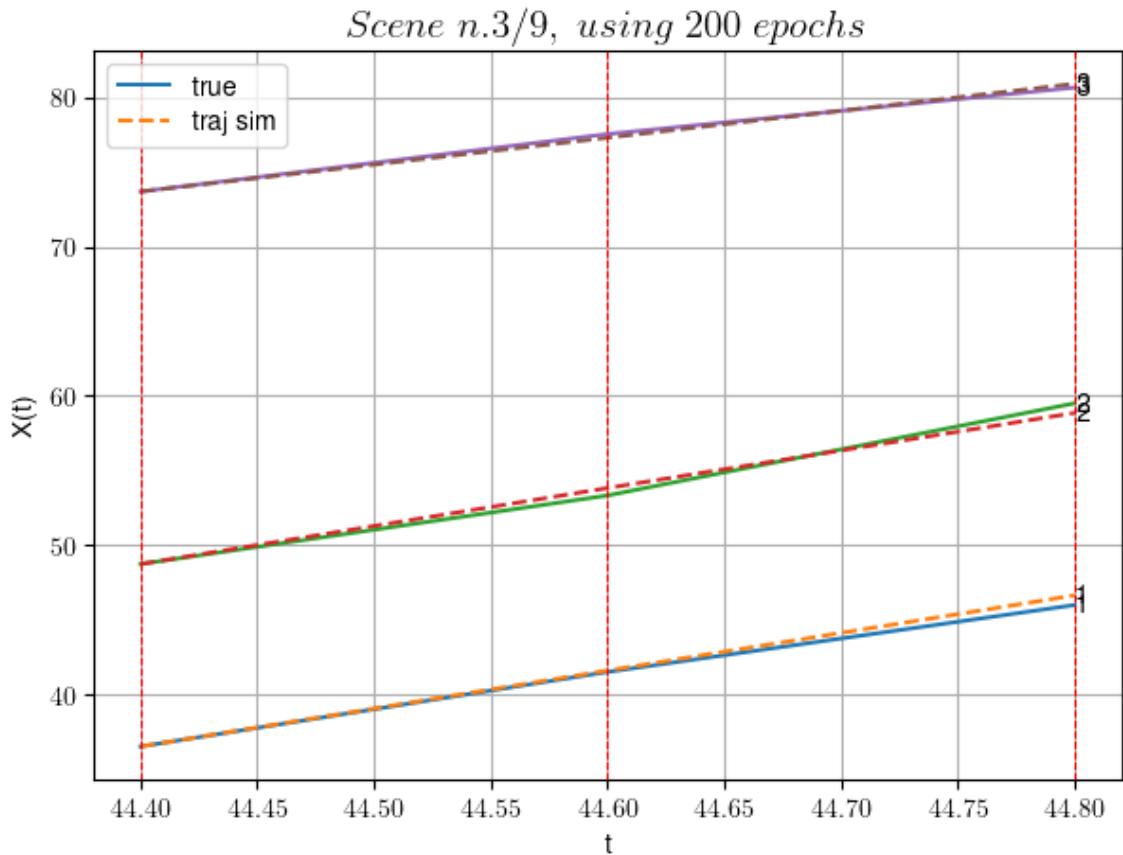
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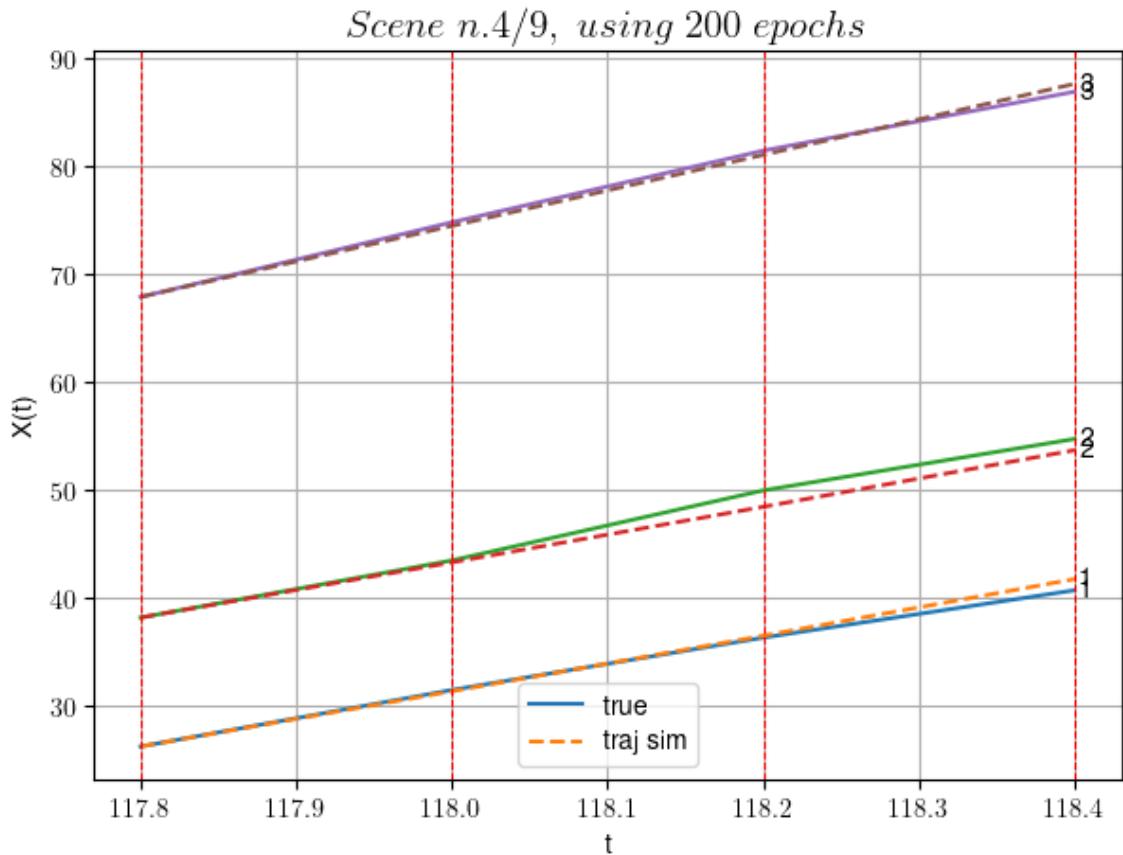
Scene n.3/9, time interval:[44.40,44.80]

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---



Scene n.4/9, time interval:[117.80,118.40]



Loss: 0.44610545310524335  
v0 updated: 32.94458888171542

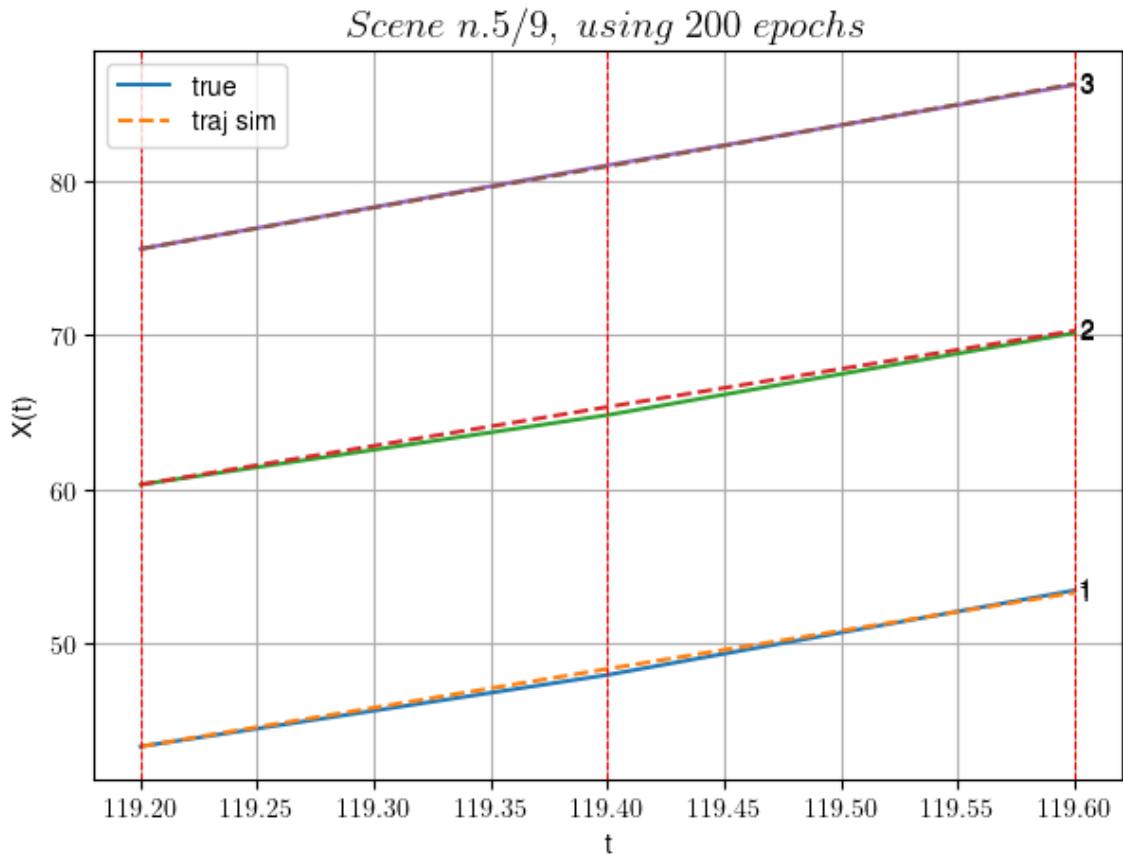
---

---

Scene n.5/9, time interval:[119.20,119.60]

---

---



Loss: 0.053791261537203455  
v0 updated: 26.738175294370425

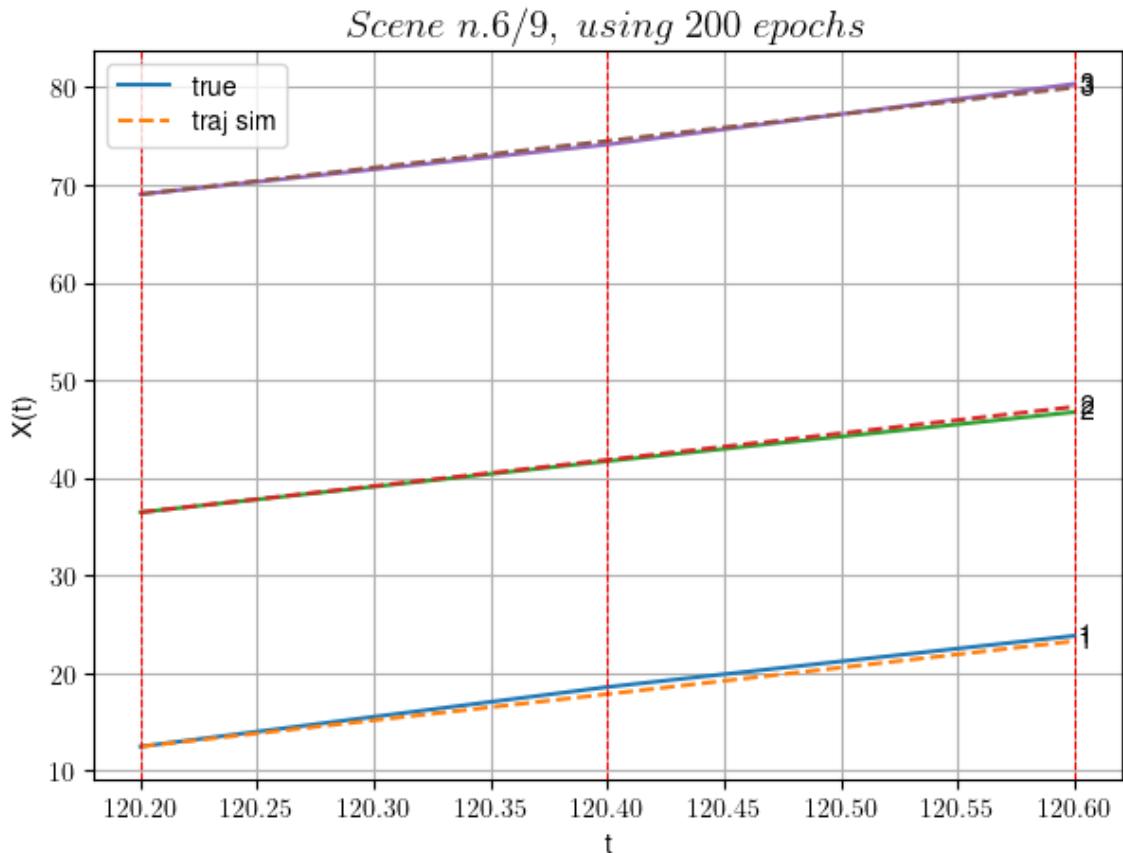
---

---

Scene n.6/9, time interval:[120.20,120.60]

---

---



Loss: 0.1569973539897888  
v0 updated: 27.35189815479499

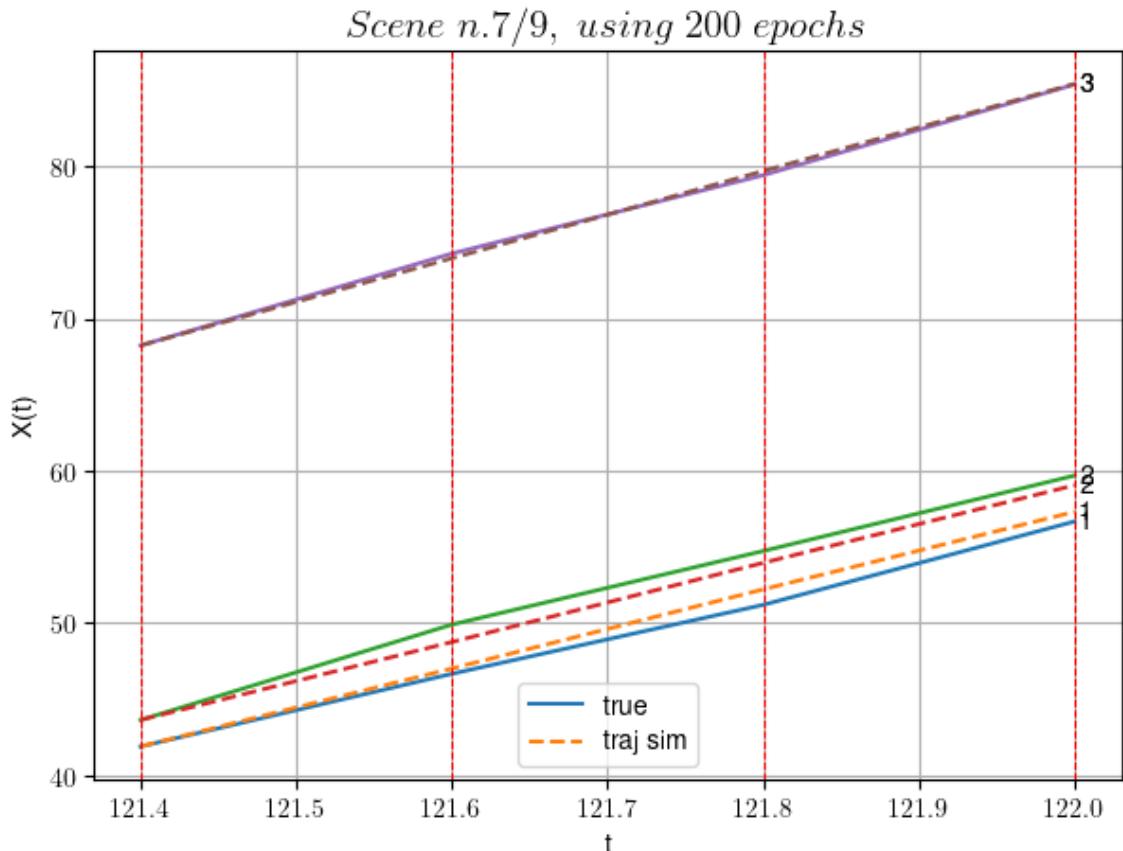
---

---

Scene n.7/9, time interval:[121.40,122.00]

---

---



Loss: 0.33765231744430696  
v0 updated: 28.659002486225642

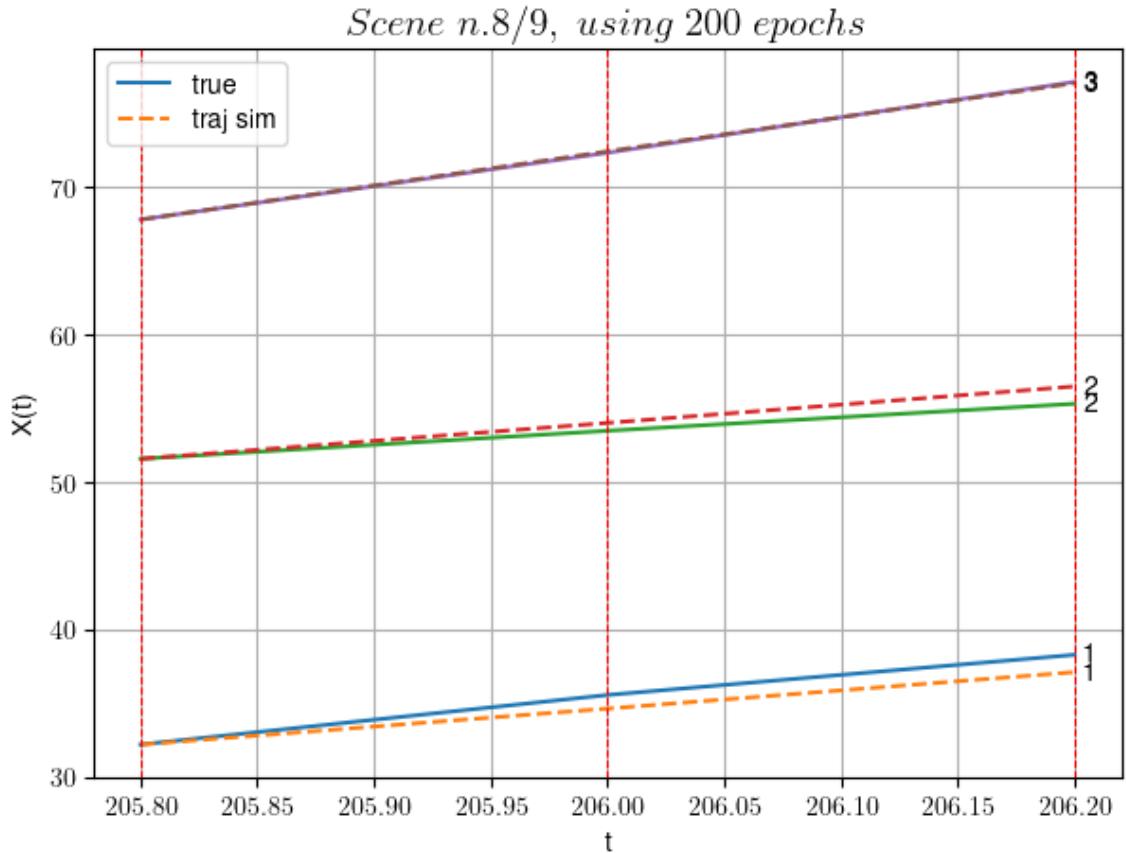
---

---

Scene n.8/9, time interval:[205.80,206.20]

---

---



Loss: 0.43722491255635093  
v0 updated: 23.166163068080635

---

---

v0\_mean in this df is: 27.382709798097288  
Time taken: 41.77s  
Hidden-Layer-1/kernel:0: [-1543128.6 -2946.929]  
Hidden-Layer-1/bias:0: [-76481.914 -237.7462]  
Output-Layer/kernel:0: [-1.2088498e+06 -3.2554160e+02]  
Output-Layer/bias:0: [12.19397]

---

---

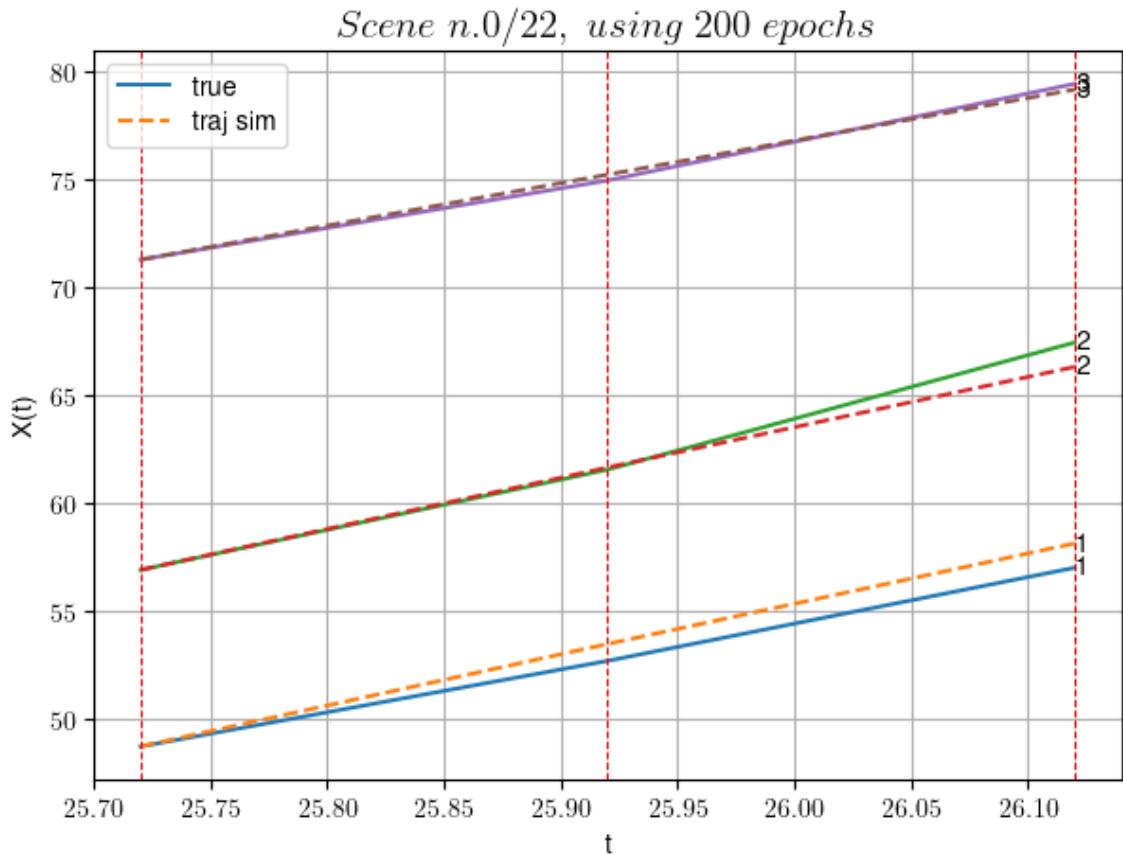
In df n.10/10 we have 22 scenes

---

Scene n.0/22, time interval:[25.72,26.12]

---

---



Loss: 0.36847348466722535  
v0 updated: 19.720083475840415

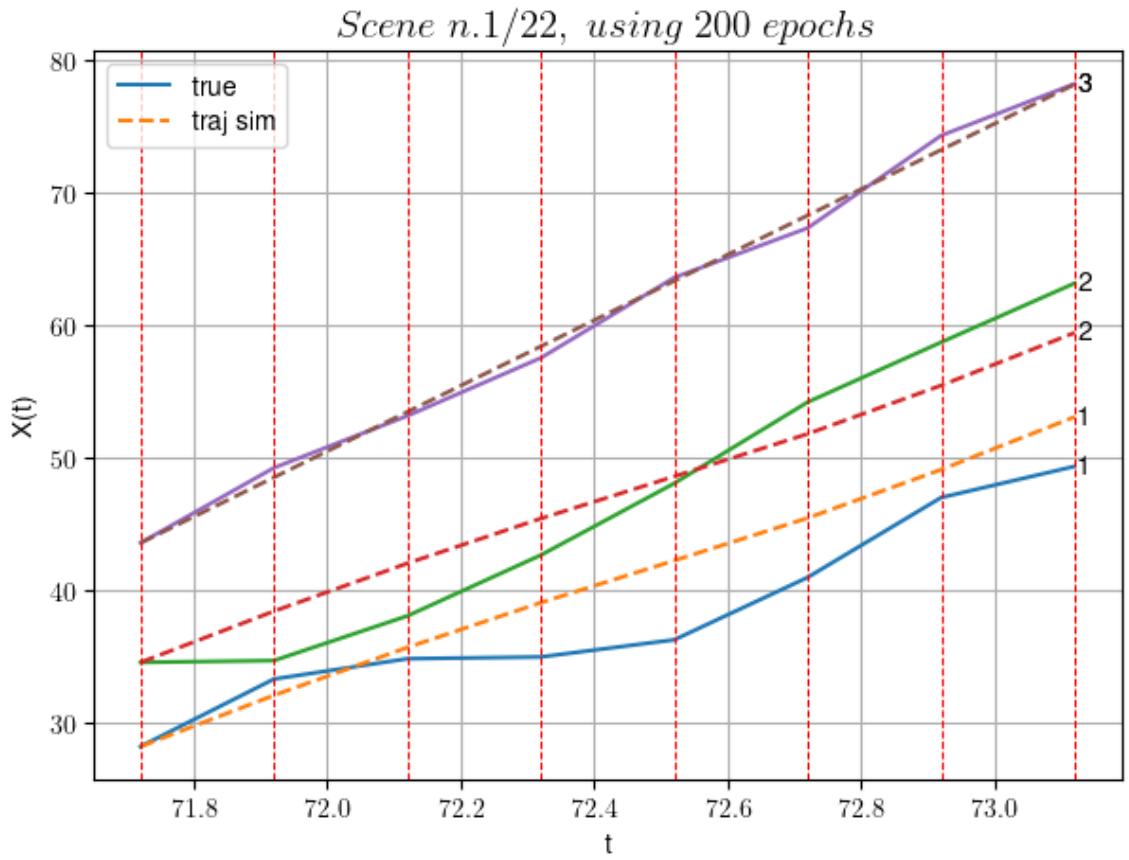
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---

Scene n.1/22, time interval:[71.72,73.12]

---

---



Loss: 6.847991360283172  
v0 updated: 24.702003765073034

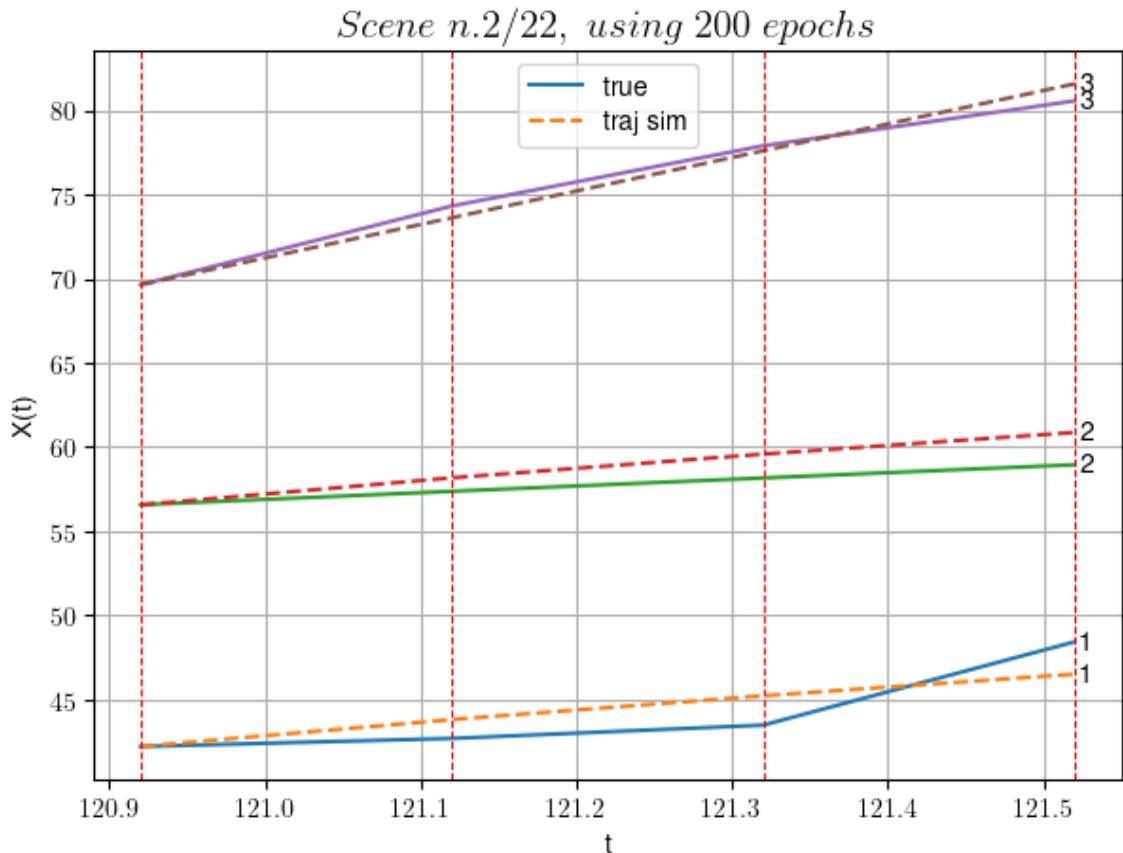
---

---

Scene n.2/22, time interval:[120.92,121.52]

---

---



Loss: 1.3263750053196102  
v0 updated: 19.88655316920097

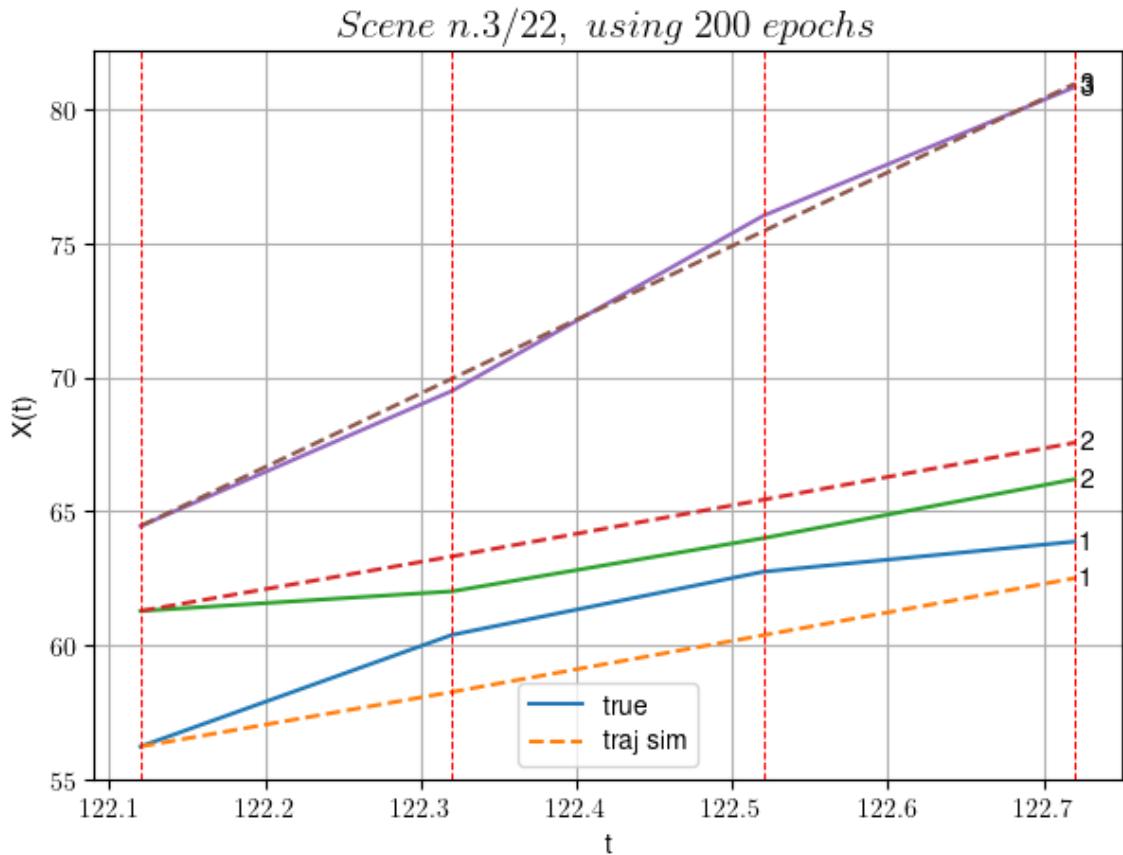
---

---

Scene n.3/22, time interval:[122.12,122.72]

---

---



Loss: 1.5196406574125596  
v0 updated: 27.530394625350453

---

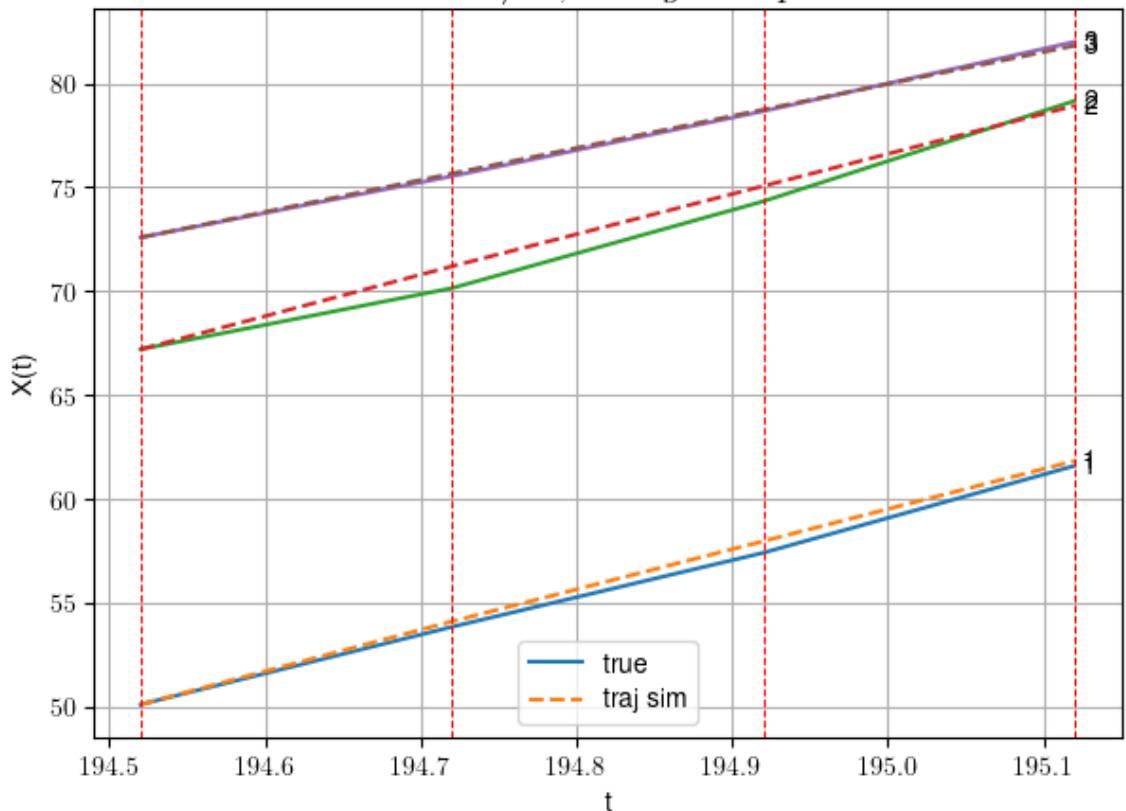
---

Scene n.4/22, time interval:[194.52,195.12]

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---

Scene n.4/22, using 200 epochs

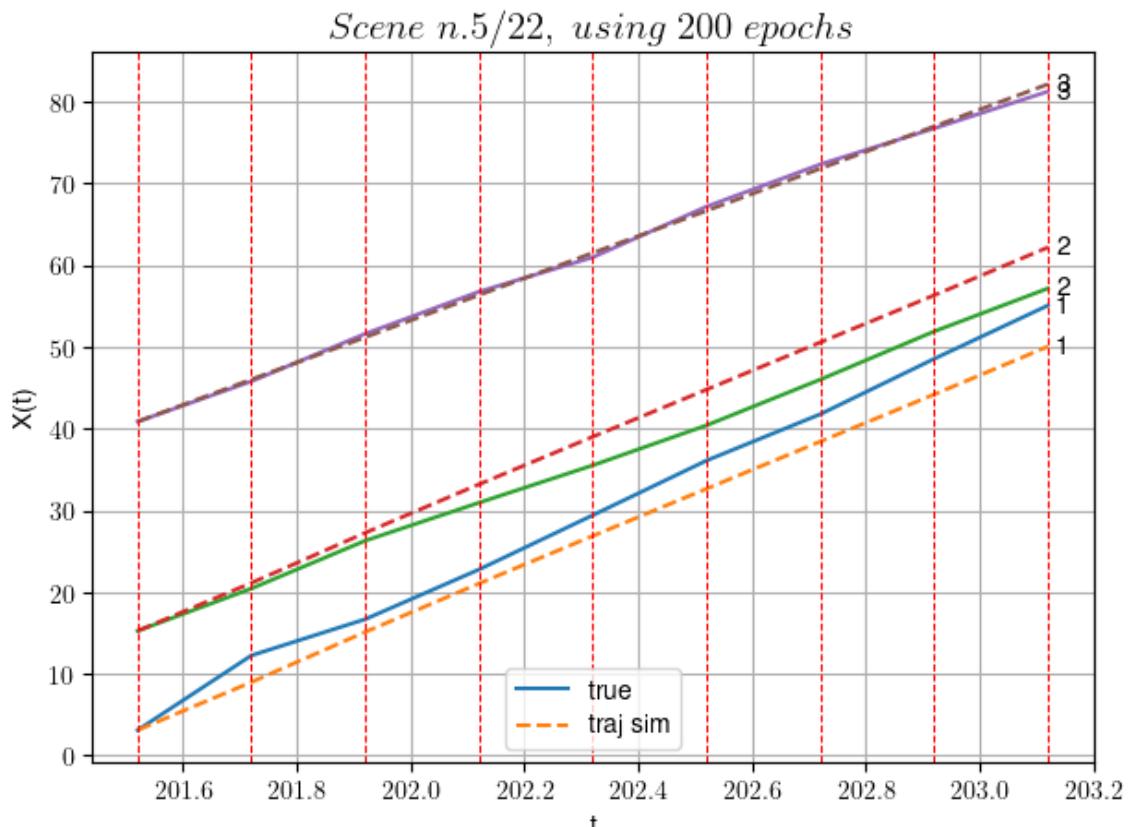


Loss: 0.18282129299481356  
v0 updated: 15.401094076291631

---

Scene n.5/22, time interval:[201.52,203.12]

---



Loss: 7.2348169552994746  
v0 updated: 25.802037842559233

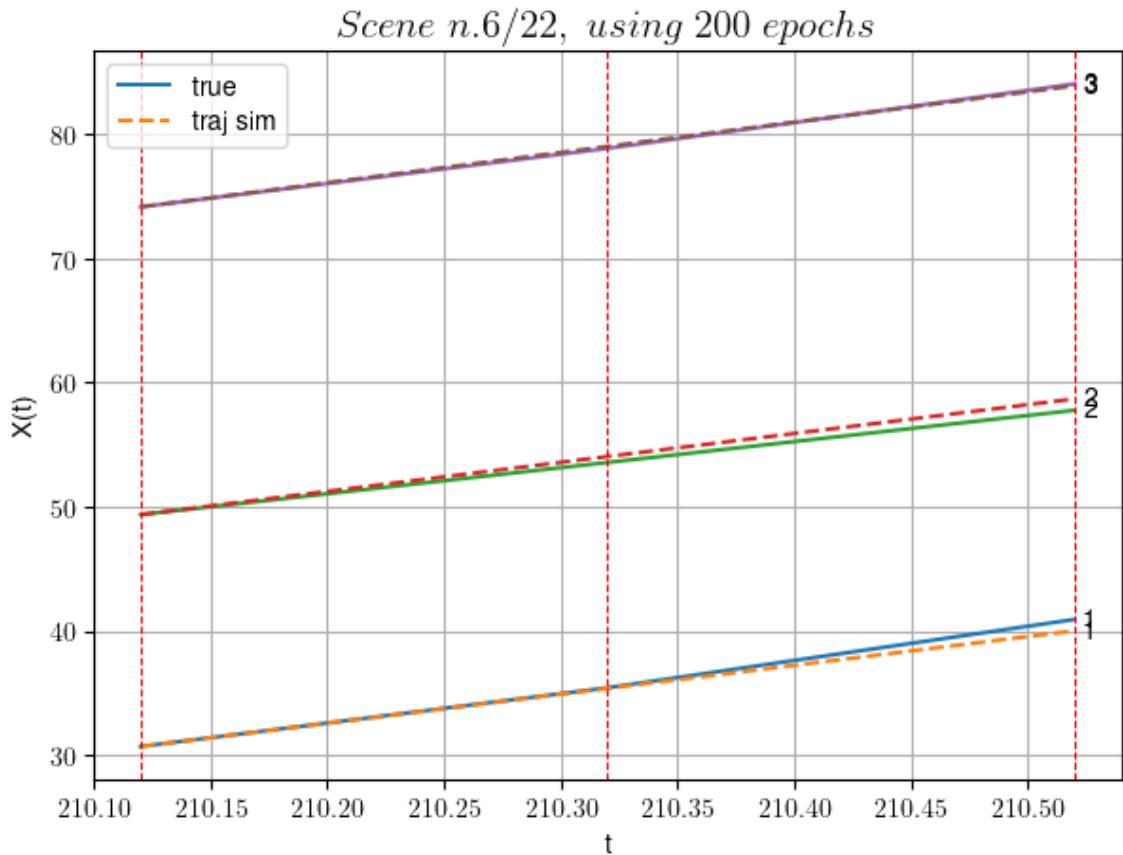
---

---

Scene n.6/22, time interval:[210.12,210.52]

---

---



Loss: 0.2172324595165367  
v0 updated: 24.389067074403897

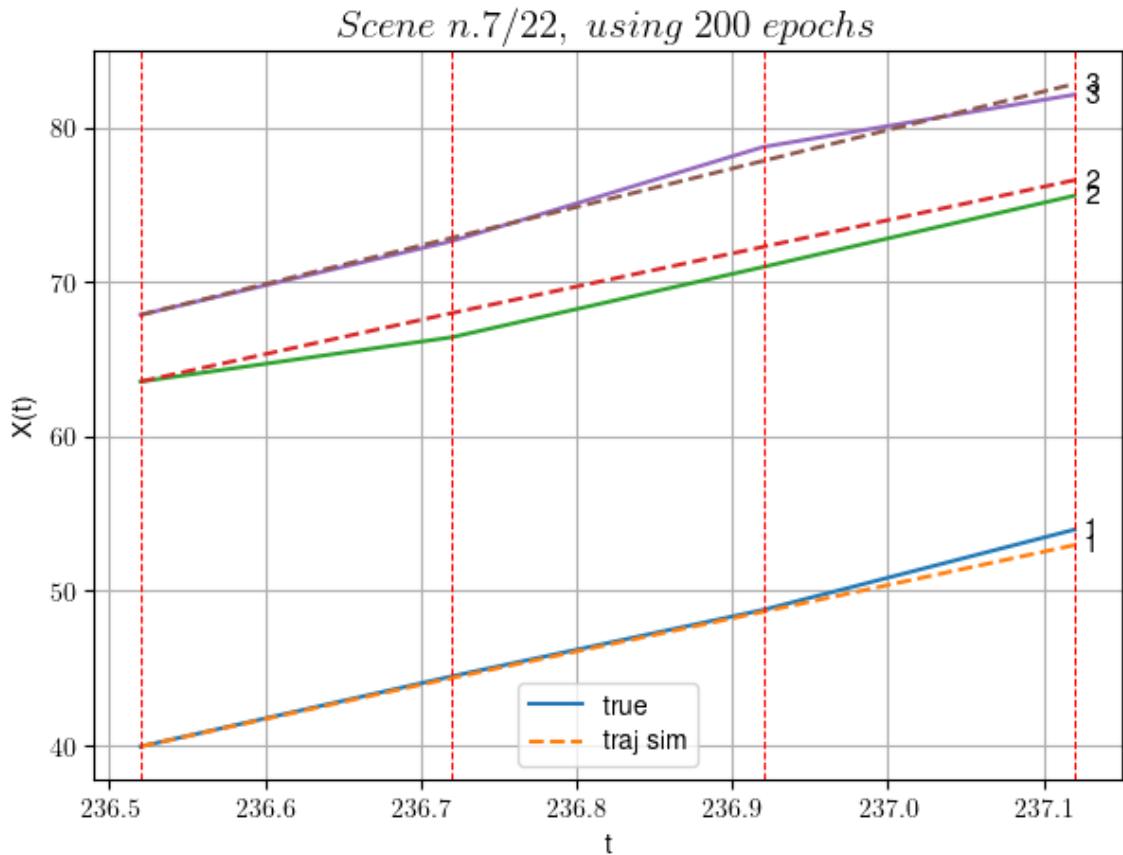
---

---

Scene n.7/22, time interval:[236.52,237.12]

---

---



Loss: 0.6288690930524585  
v $\theta$  updated: 24.94981202511928

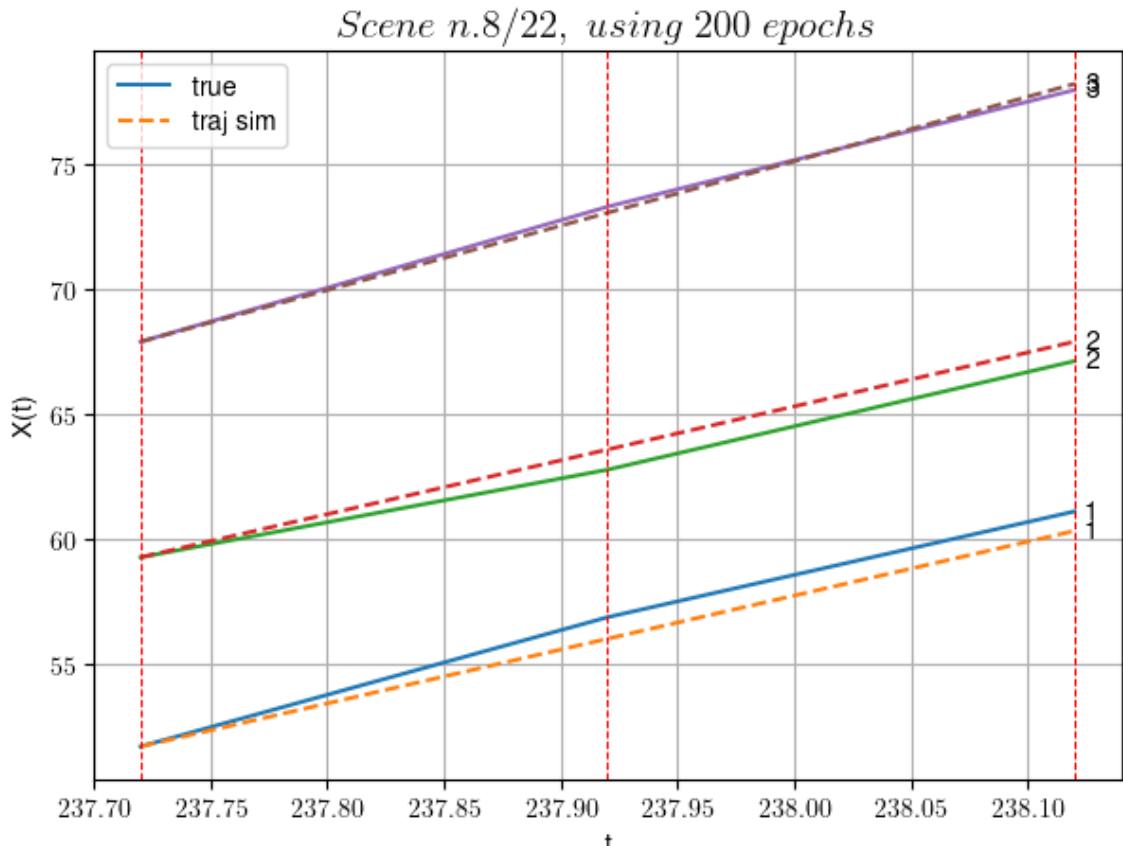
---

---

Scene n.8/22, time interval:[237.72,238.12]

---

---



Loss: 0.3032408935149323  
v0 updated: 25.837168308446394

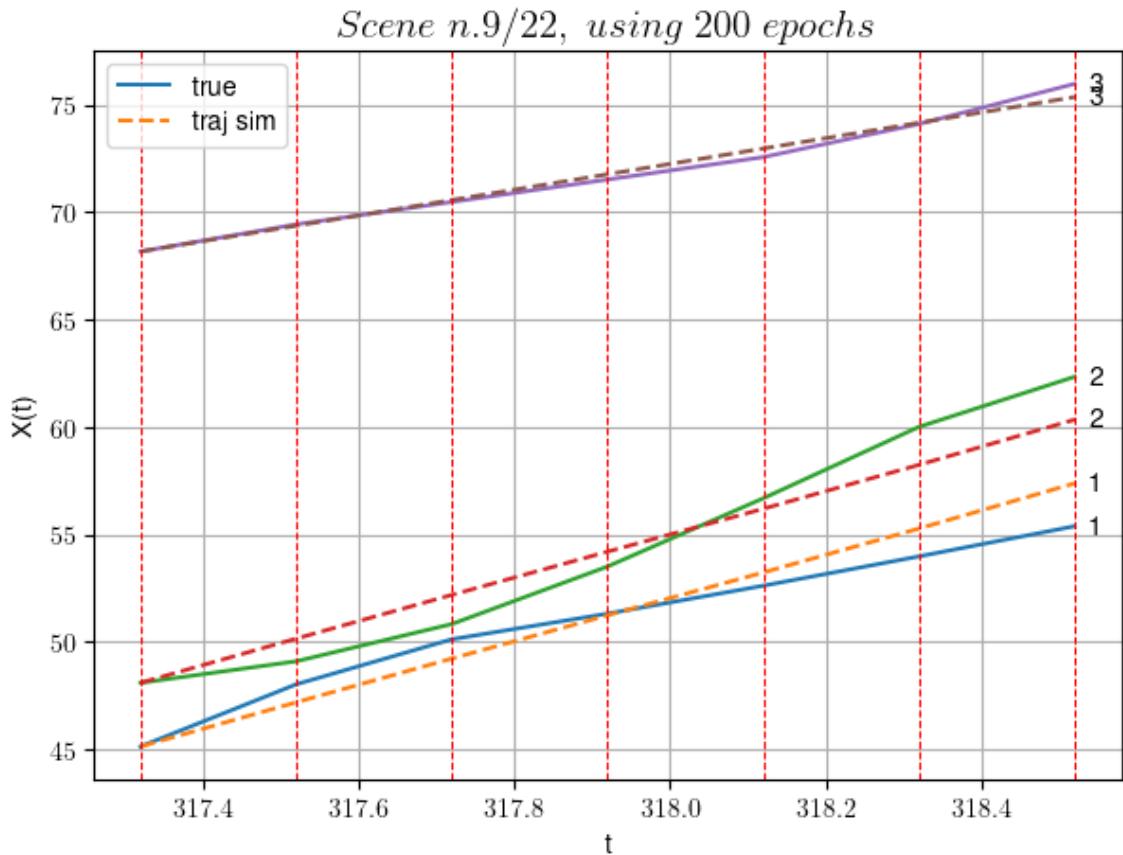
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---

Scene n.9/22, time interval:[317.32,318.52]

---

---



Loss: 0.9012554819457385  
v0 updated: 5.985788274819661

---

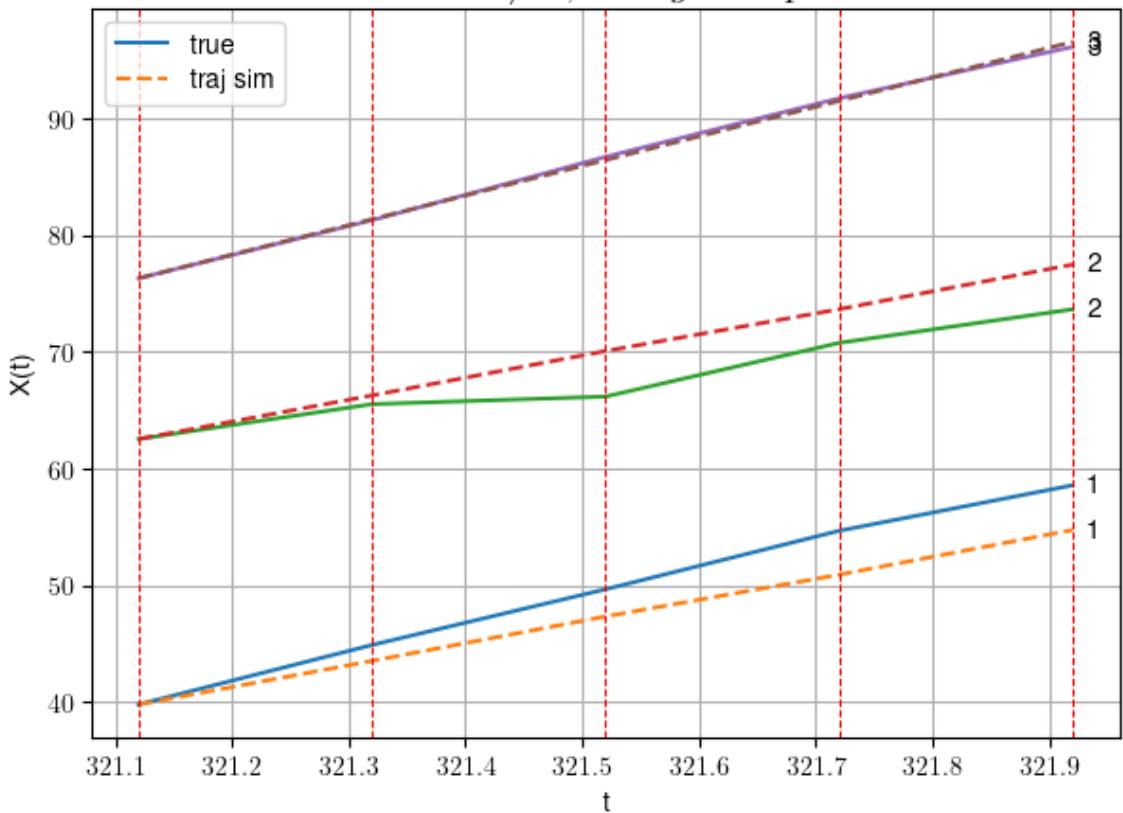
---

Scene n.10/22, time interval:[321.12,321.92]

---

---

Scene n.10/22, using 200 epochs



Loss: 5.014852959823415  
v0 updated: 25.333558083094214

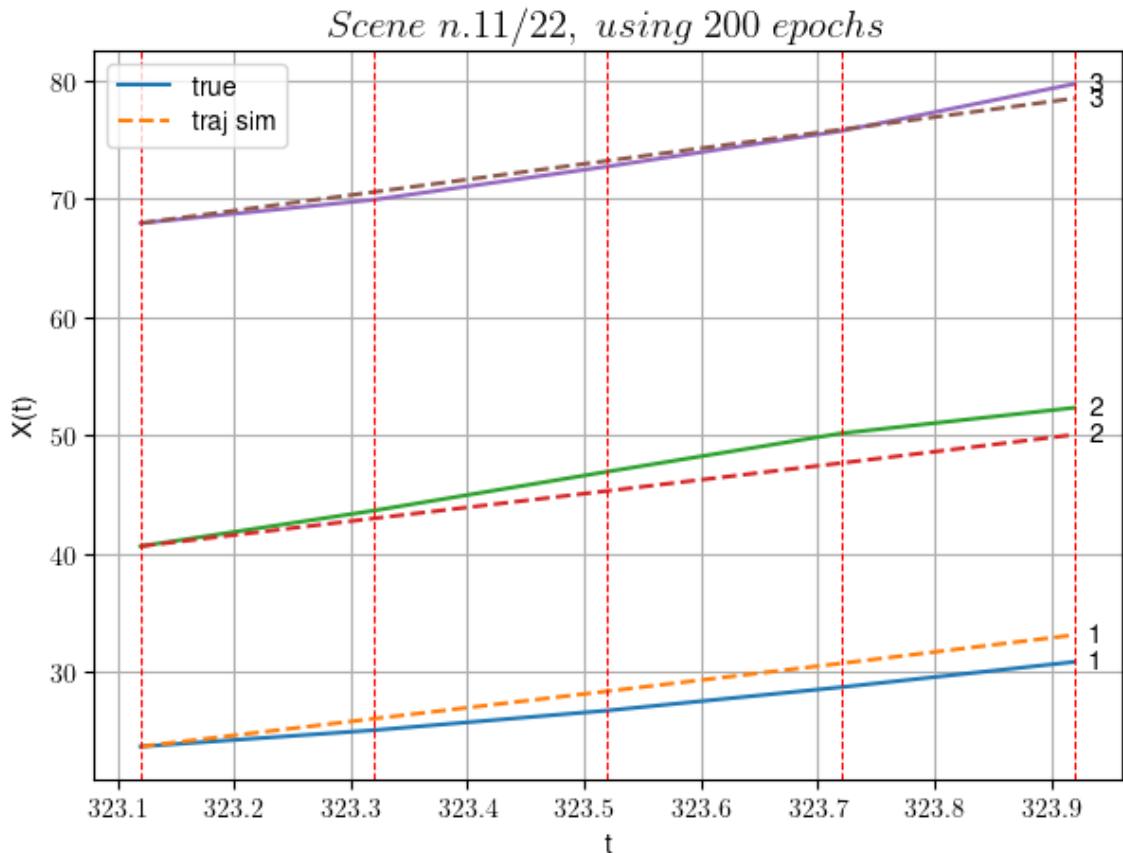
---

---

Scene n.11/22, time interval:[323.12,323.92]

---

---



Loss: 1.971125040597303  
v0 updated: 13.179806245671685

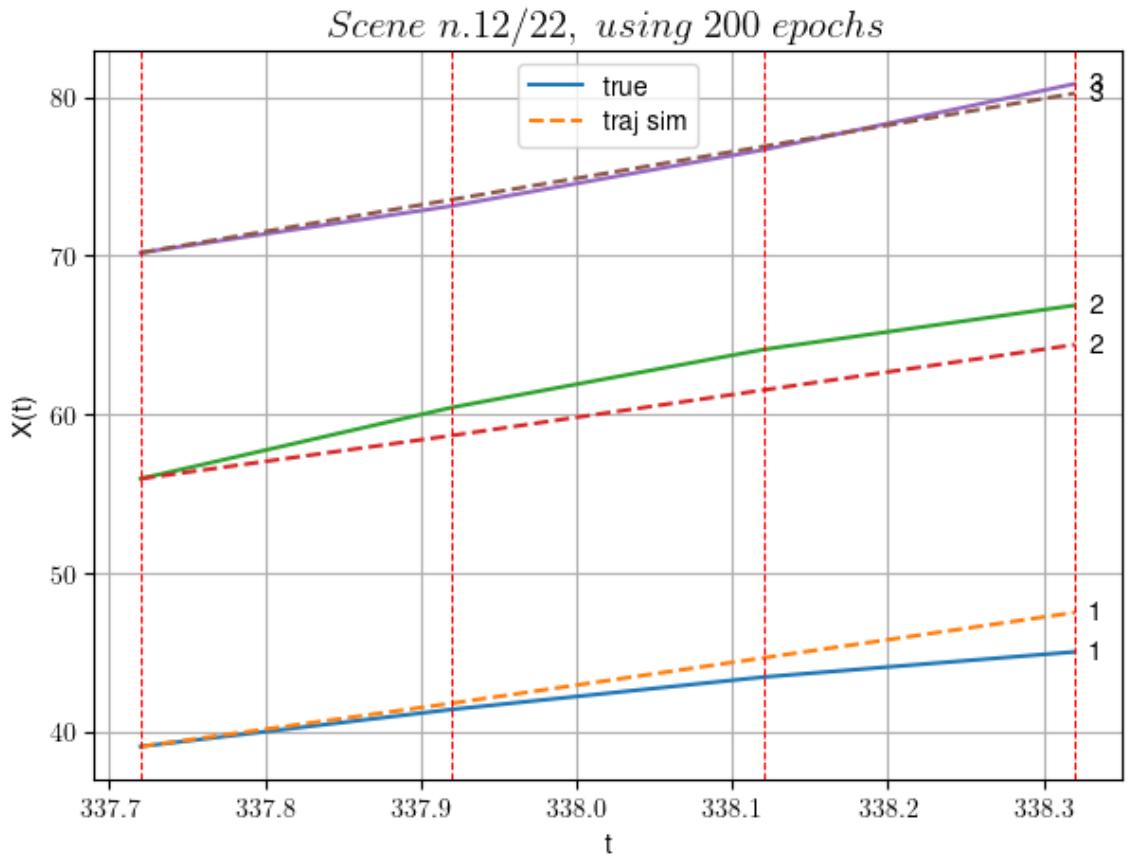
---

---

Scene n.12/22, time interval:[337.72,338.32]

---

---



Loss: 2.0157349917027507  
v0 updated: 16.753005814325554

---

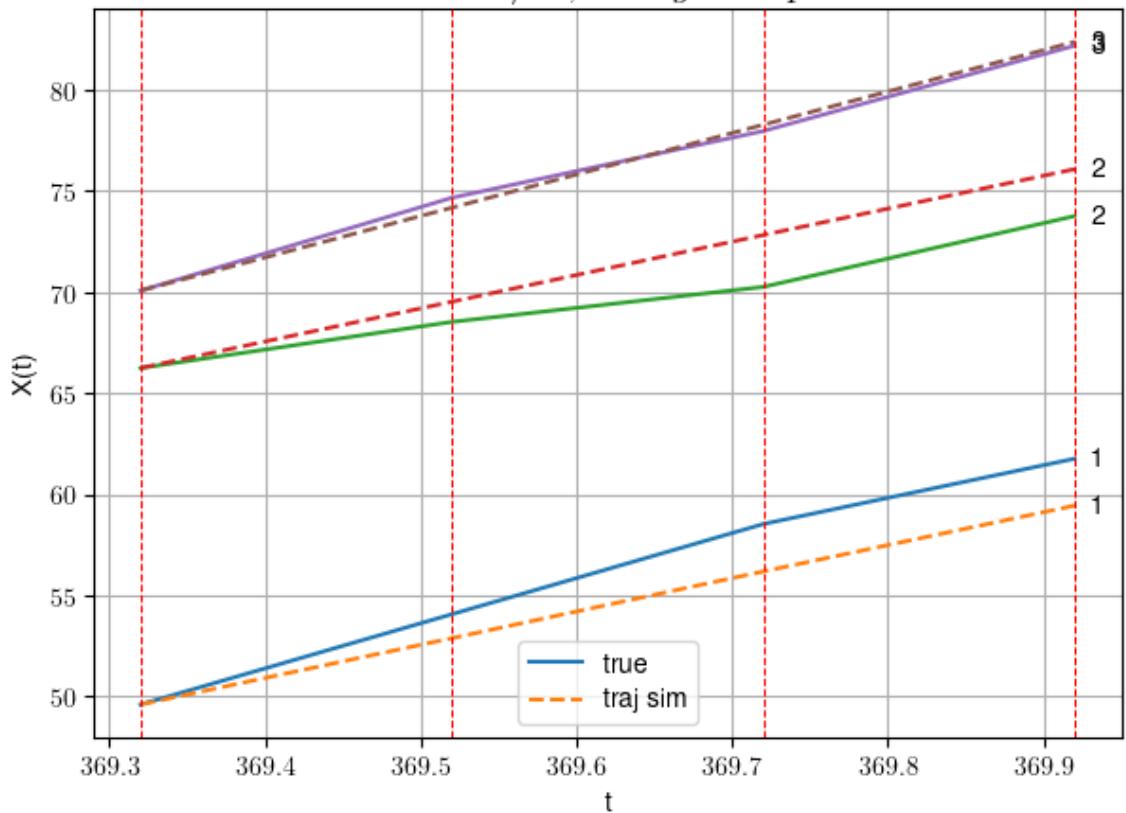
---

Scene n.13/22, time interval:[369.32,369.92]

---

---

Scene n.13/22, using 200 epochs

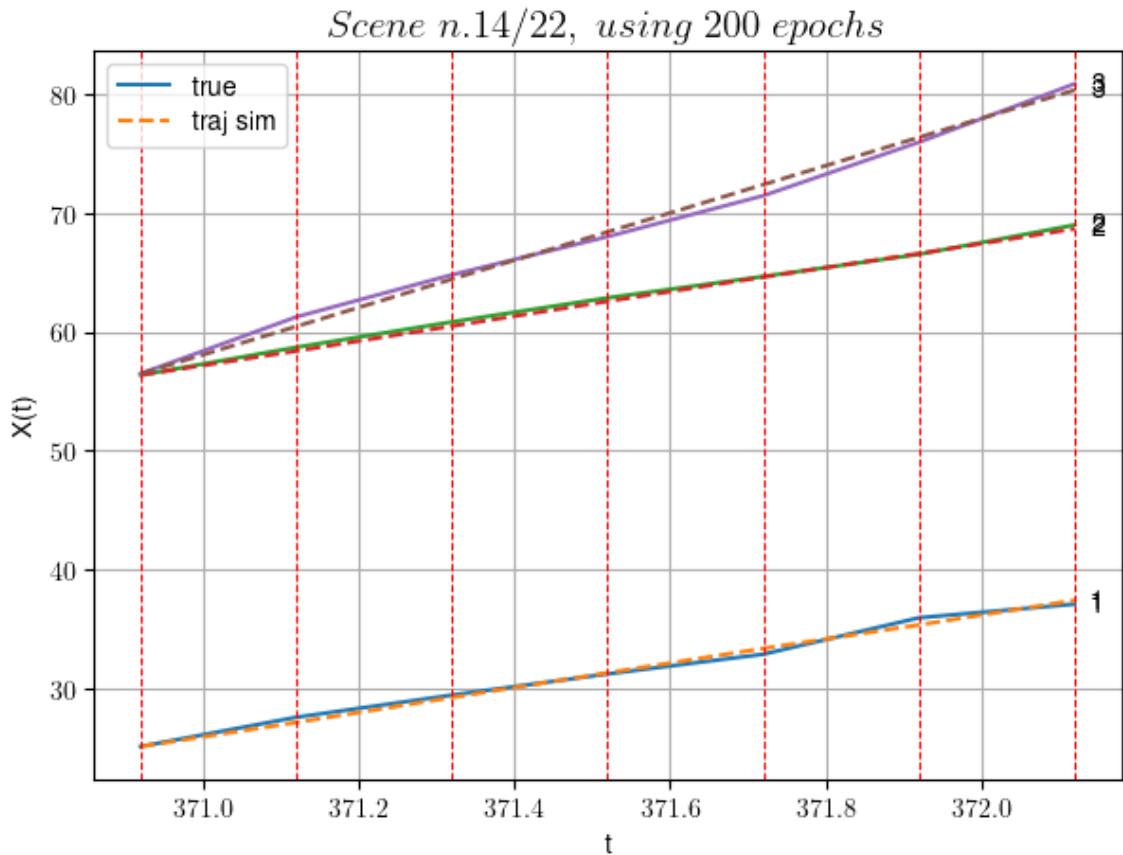


Loss: 2.139113283649327  
v0 updated: 20.519283368429512

---

Scene n.14/22, time interval:[370.92,372.12]

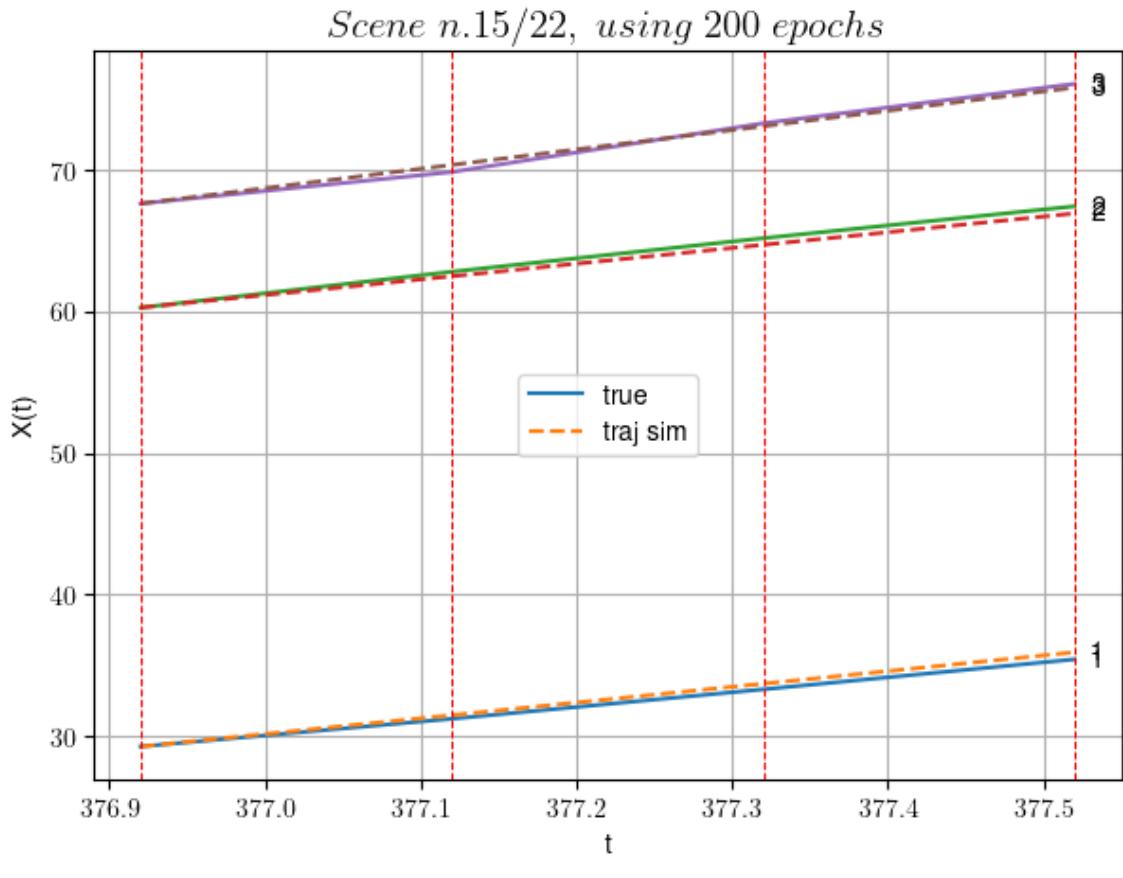
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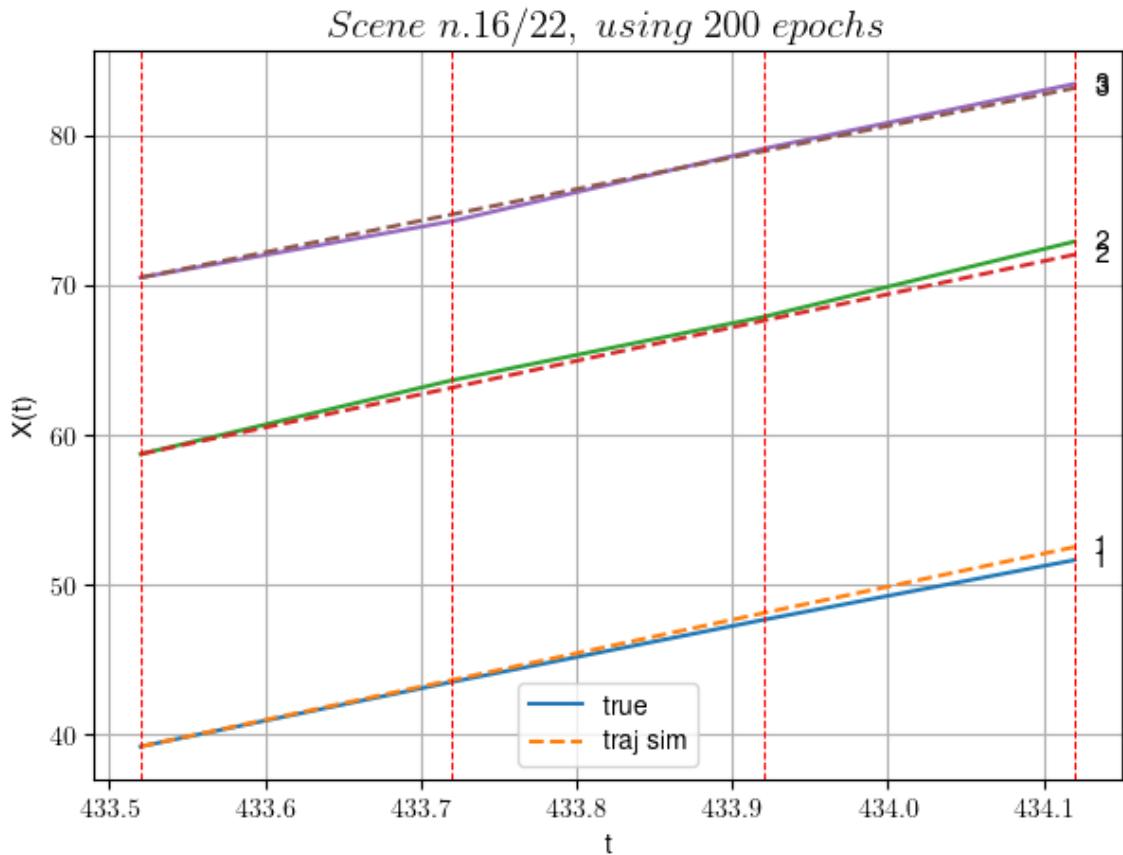
---

Scene n.15/22, time interval:[376.92,377.52]

---



Scene n.16/22, time interval:[433.52,434.12]



Loss: 0.19647536597438106  
v0 updated: 21.105455587309343

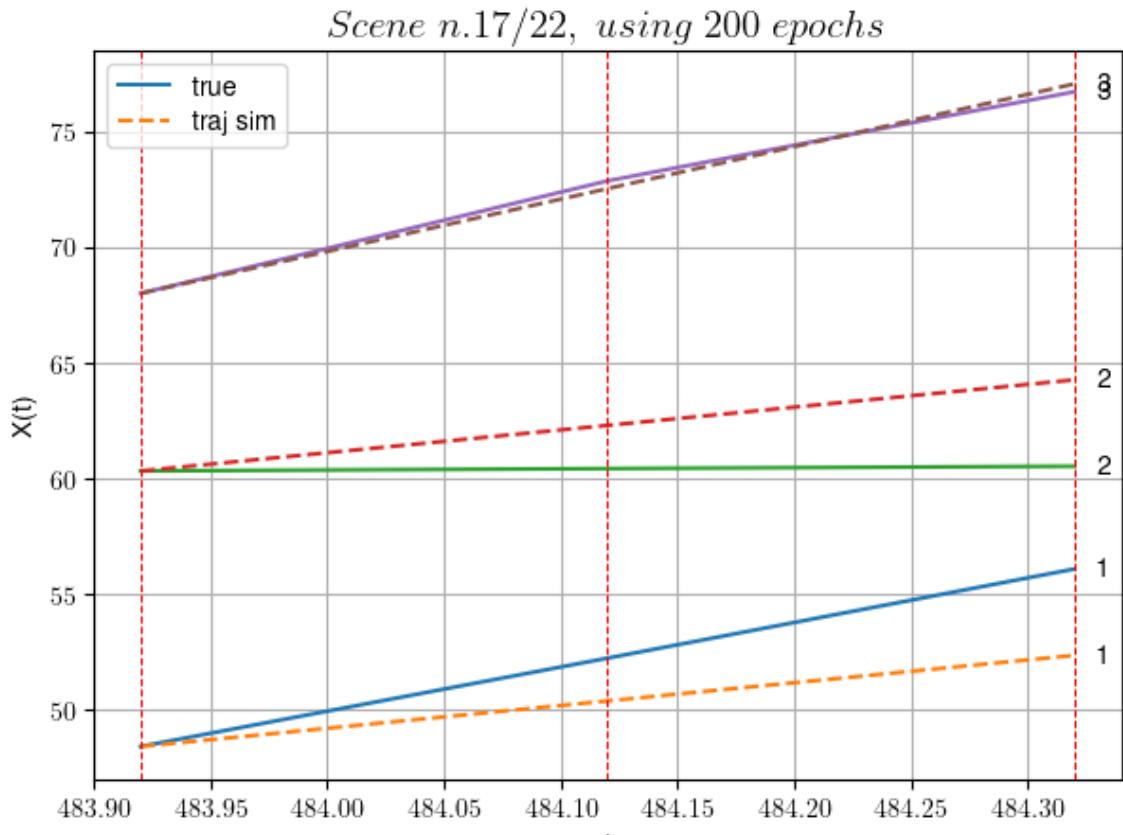
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---

Scene n.17/22, time interval:[483.92,484.32]

---

---



Loss: 3.8862334834657037  
v0 updated: 22.627021467100167

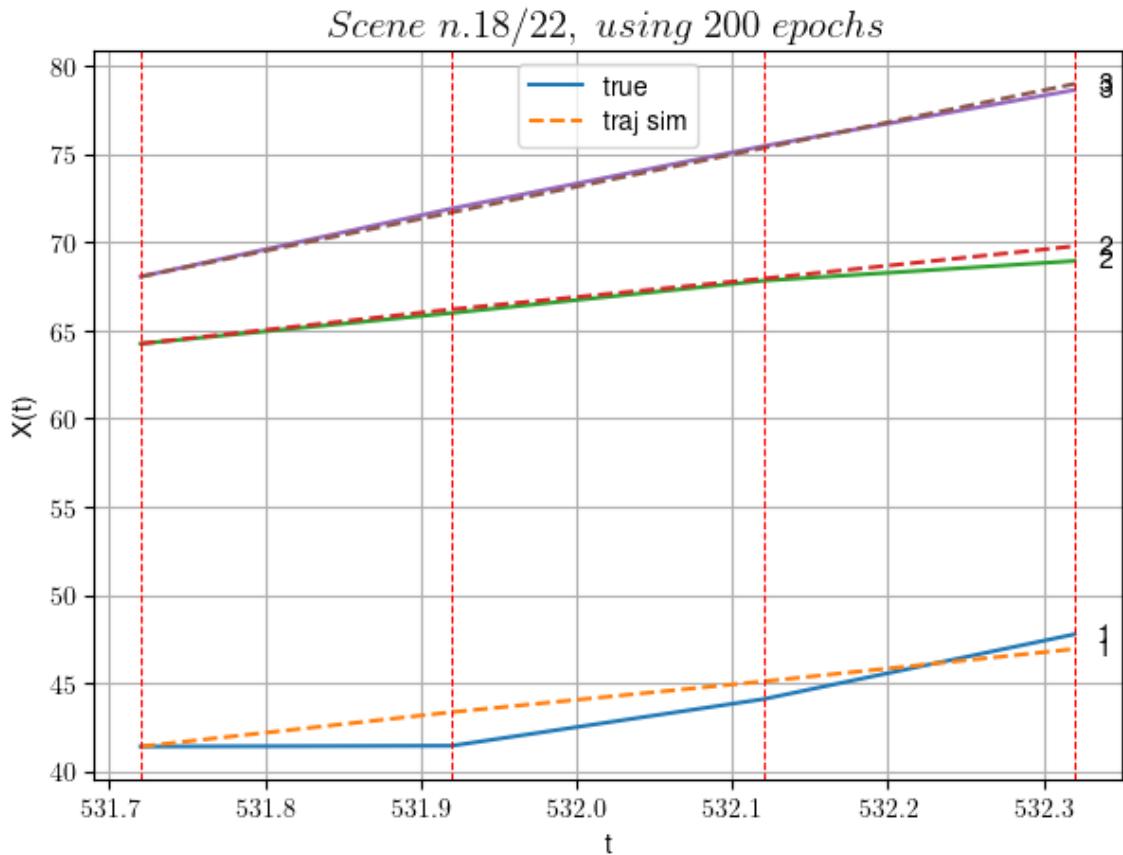
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---

Scene n.18/22, time interval:[531.72,532.32]

---

---



Loss: 0.5238435145756729  
v0 updated: 18.218124824359563

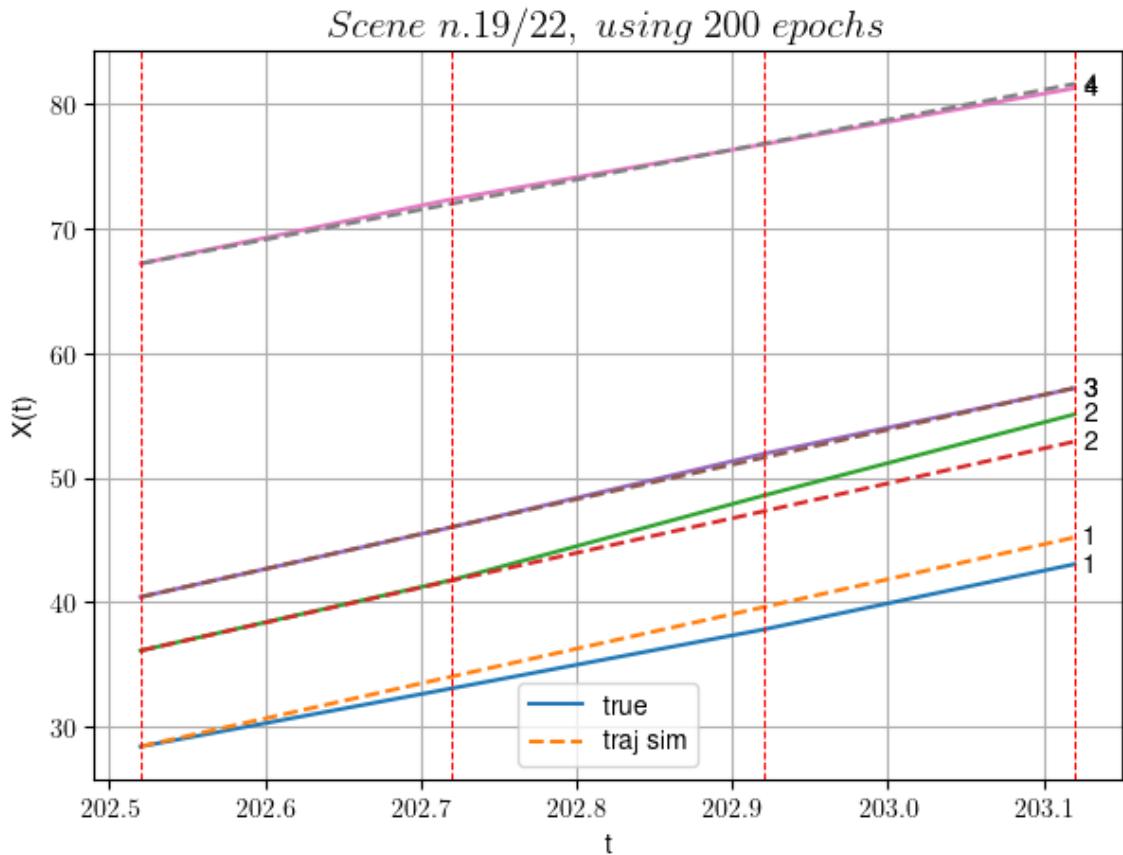
---

---

Scene n.19/22, time interval:[202.52,203.12]

---

---



Loss: 0.9657045257352089  
v0 updated: 24.051027652058547

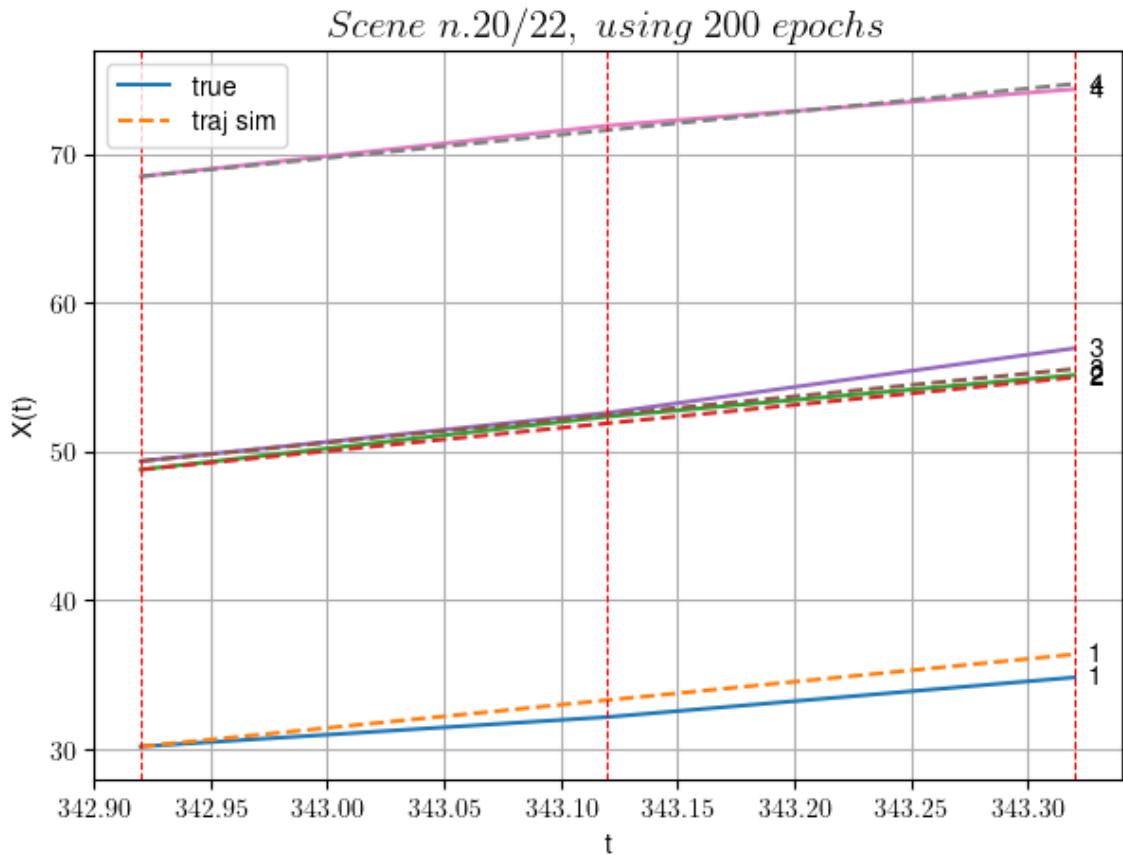
---

---

Scene n.20/22, time interval:[342.92,343.32]

---

---



Loss: 0.5077826544566133  
v0 updated: 15.561057585233684

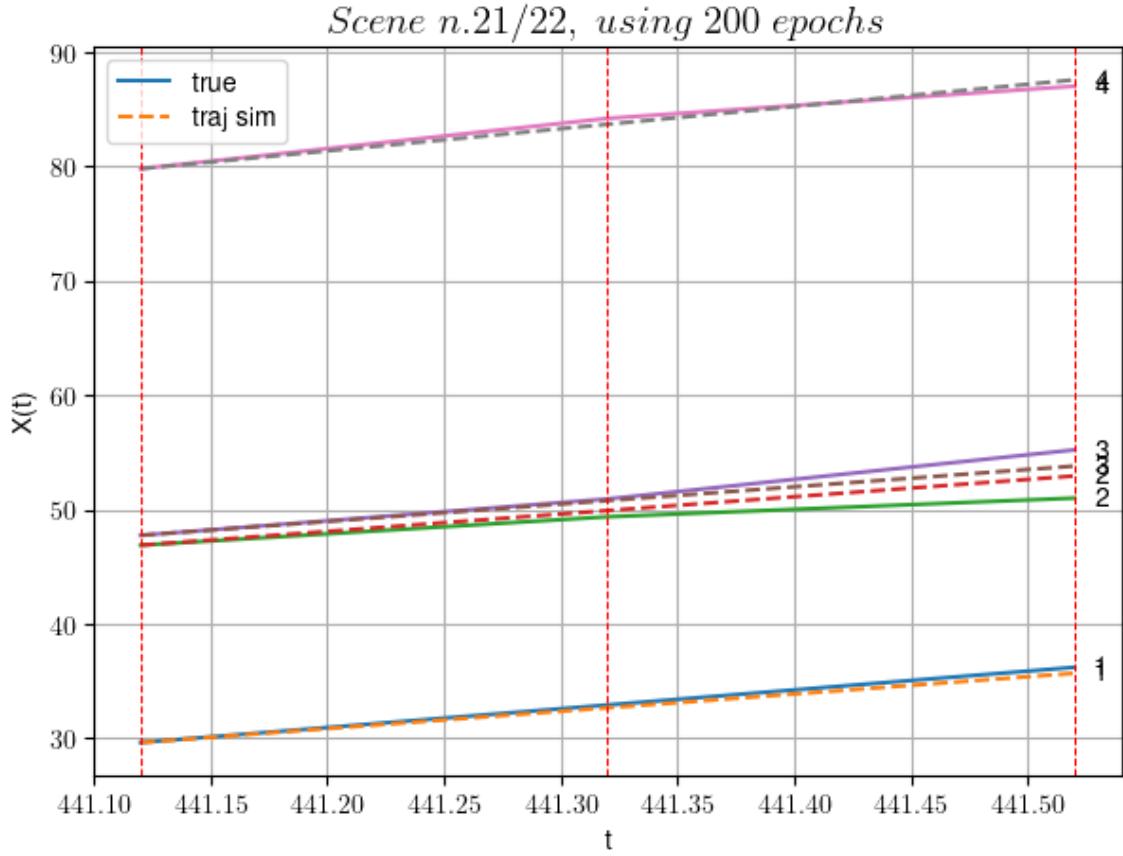
---

---

Scene n.21/22, time interval:[441.12,441.52]

---

---



Loss: 0.580726939397526  
 $v_0$  updated: 19.41820764628245

---



---

$v_0$  mean in this df is: 21.71946552014369

Time taken: 122.86s

Hidden-Layer-1/kernel:0: [-1543128.6 -2946.929]

Hidden-Layer-1/bias:0: [-76481.914 -237.7462]

Output-Layer/kernel:0: [-1.2088498e+06 -3.2554160e+02]

Output-Layer/bias:0: [15.159494]

---

To complete the dataset with NN structure: 1-2-1 we spent: 1160.10s

Model: "sequential\_1"

Layer (type)	Output Shape	Param #
Hidden-Layer-1 (Dense)	(None, 4)	8
Output-Layer (Dense)	(None, 1)	5

---

Total params: 13

Trainable params: 13

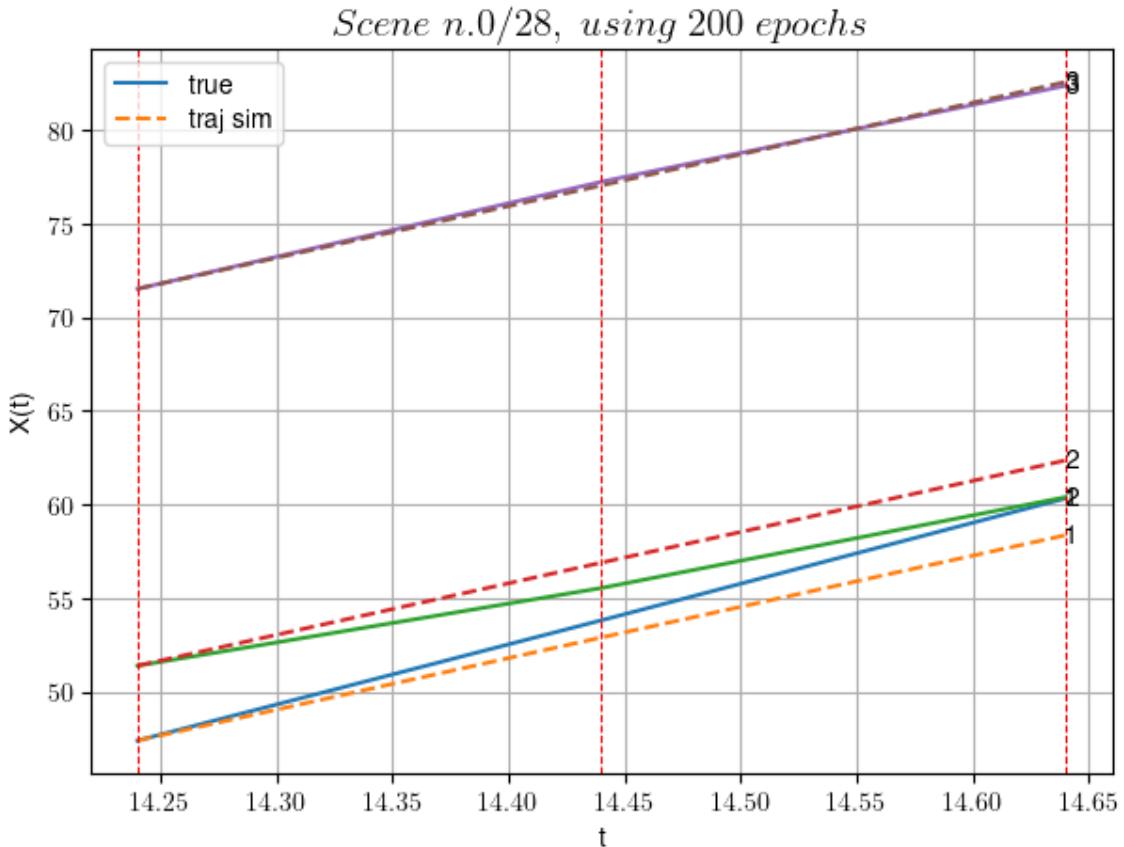
Non-trainable params: 0

Hidden-Layer-1/kernel:0: 7 7 0.43507314]	[-0.55419874 -0.42950106 0.145952
Hidden-Layer-1/bias:0: 01]	[0.4984548 0.40758348 0.4603989 0.136703

Output-Layer/kernel:0: [-0.44206238 -0.8977735 0.271415 -0.01449728]  
Output-Layer/bias:0: [-0.46947384]  
=====  
NN structure: 1-4-1  
=====

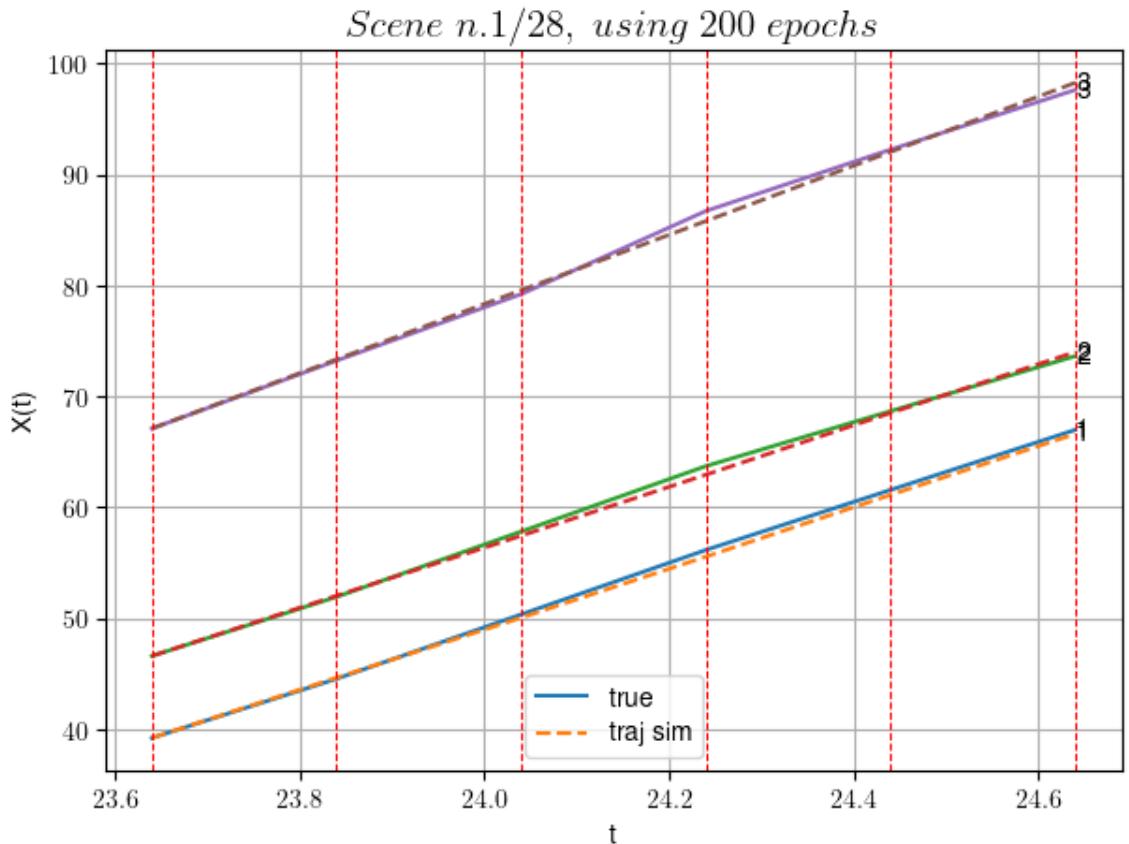
In df n.1/10 we have 28 scenes

Scene n.0/28, time interval:[14.24,14.64]



Loss: 1.166841799902858  
v0 updated: 27.63887368317861

Scene n.1/28, time interval:[23.64,24.64]



Loss: 0.17461963417344883  
v0 updated: 31.183120056293088

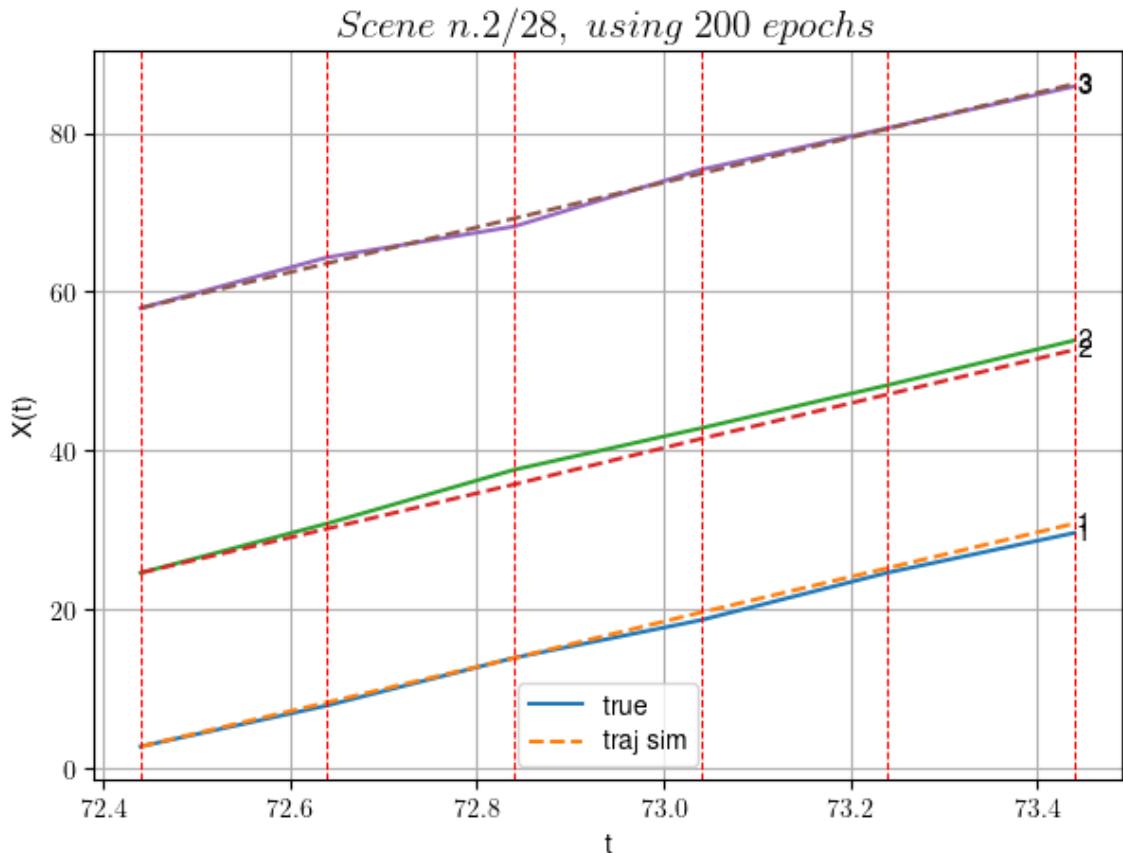
---

---

Scene n.2/28, time interval:[72.44,73.44]

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---



Loss: 0.7298870677744008  
v0 updated: 28.25284108639968

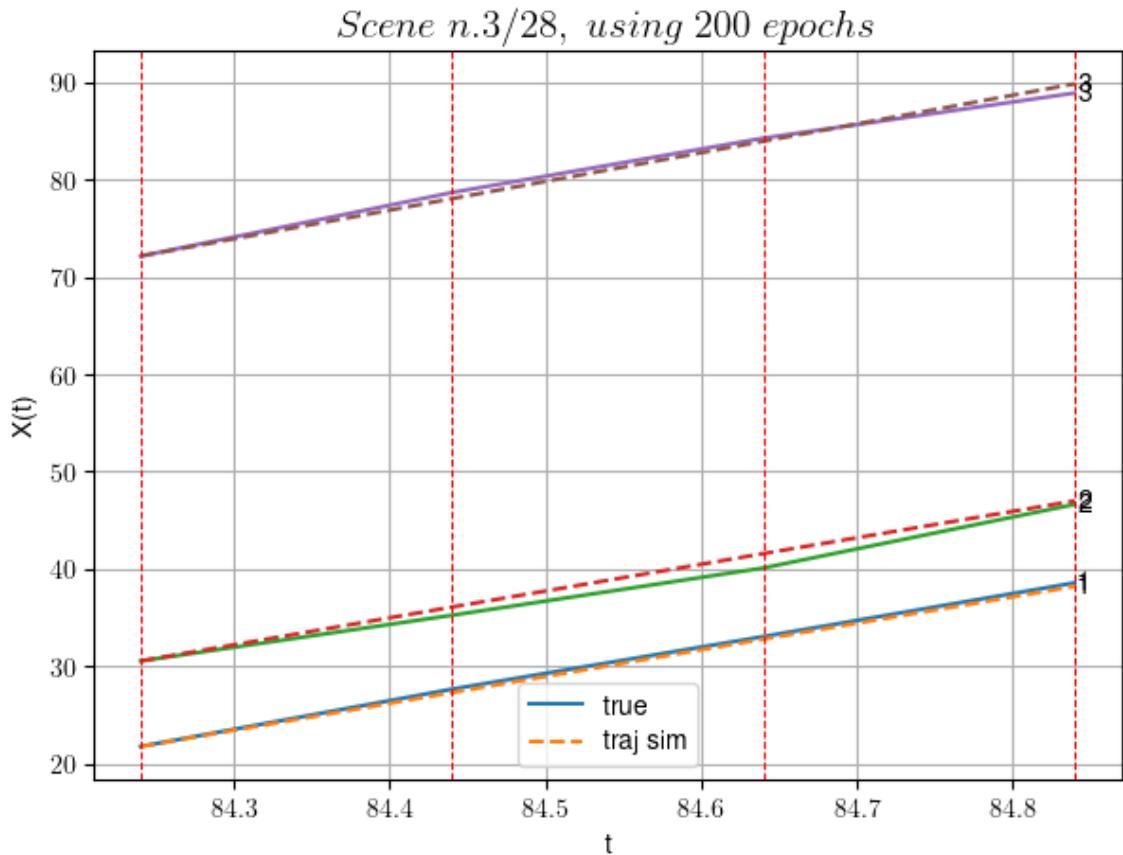
---

---

Scene n.3/28, time interval:[84.24,84.84]

---

---



Loss: 0.3949290128852662  
v0 updated: 29.49492078688976

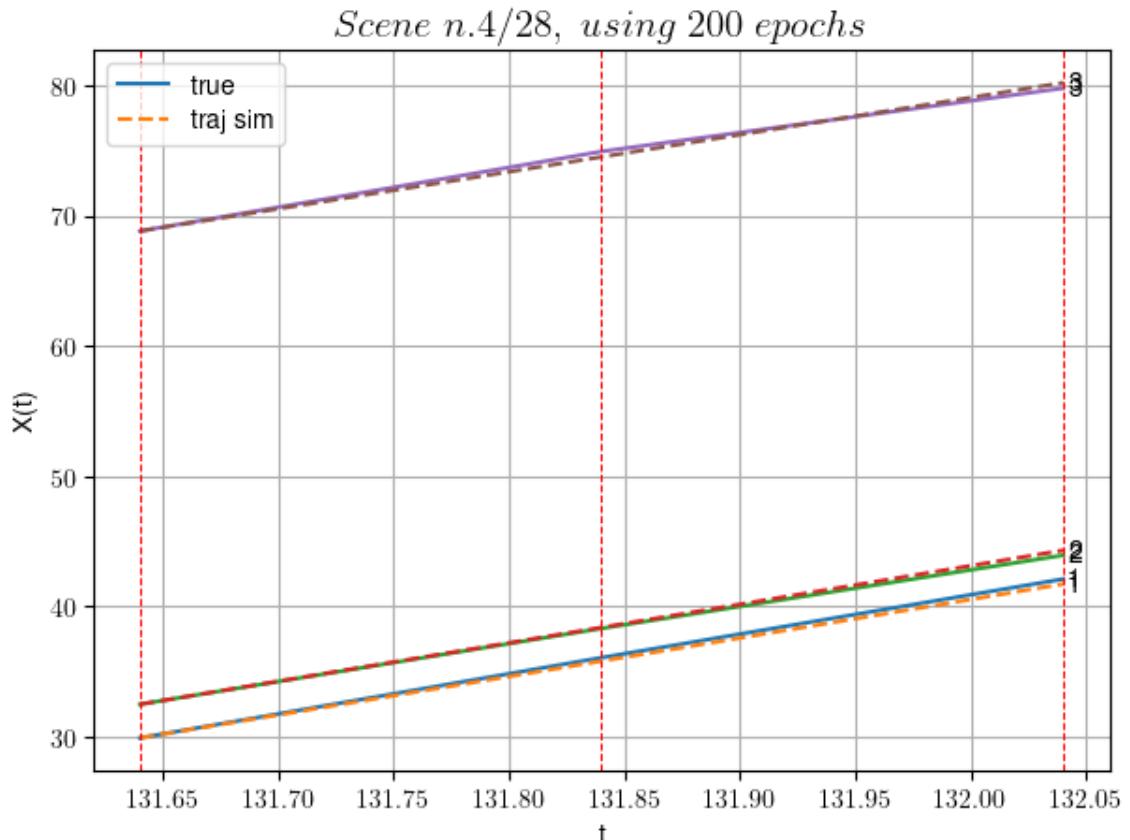
---

---

Scene n.4/28, time interval:[131.64,132.04]

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---

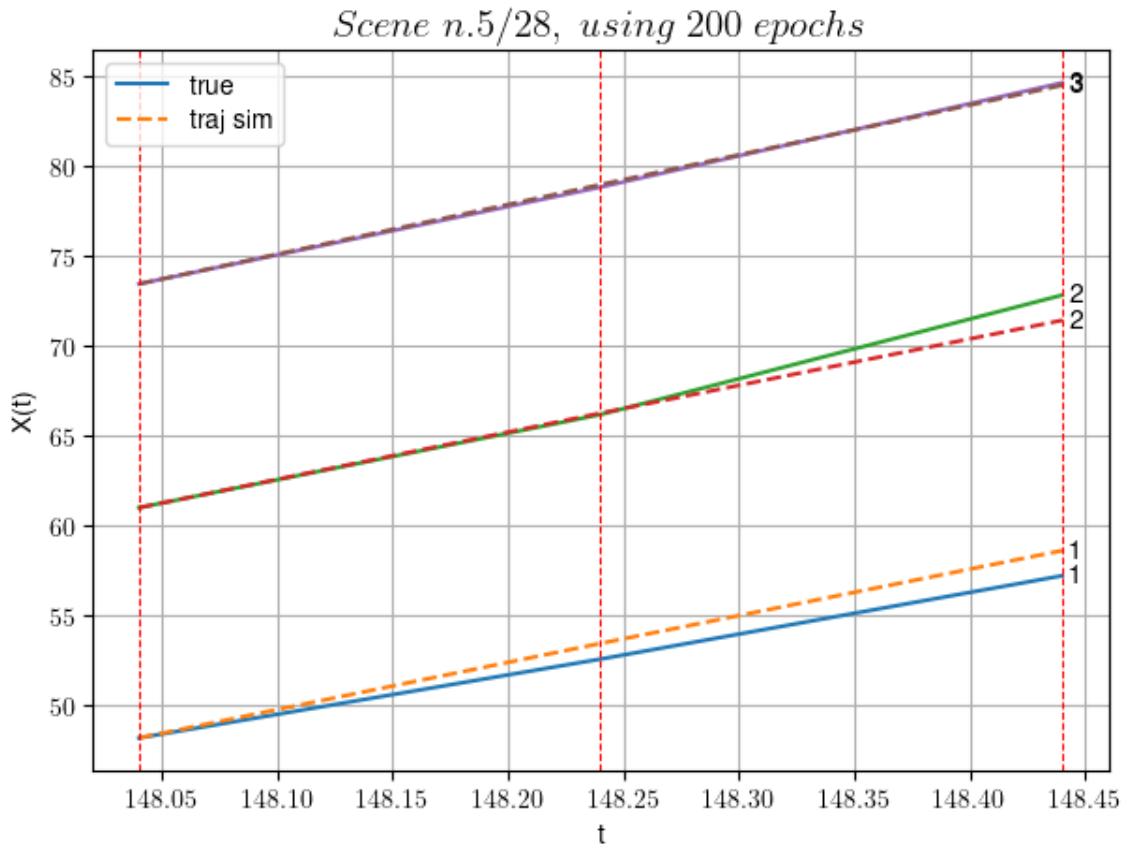


Loss: 0.0787077595901959  
v0 updated: 28.444602426787018

---

Scene n.5/28, time interval:[148.04,148.44]

---



Loss: 0.5249261951740155  
v0 updated: 27.624268173797052

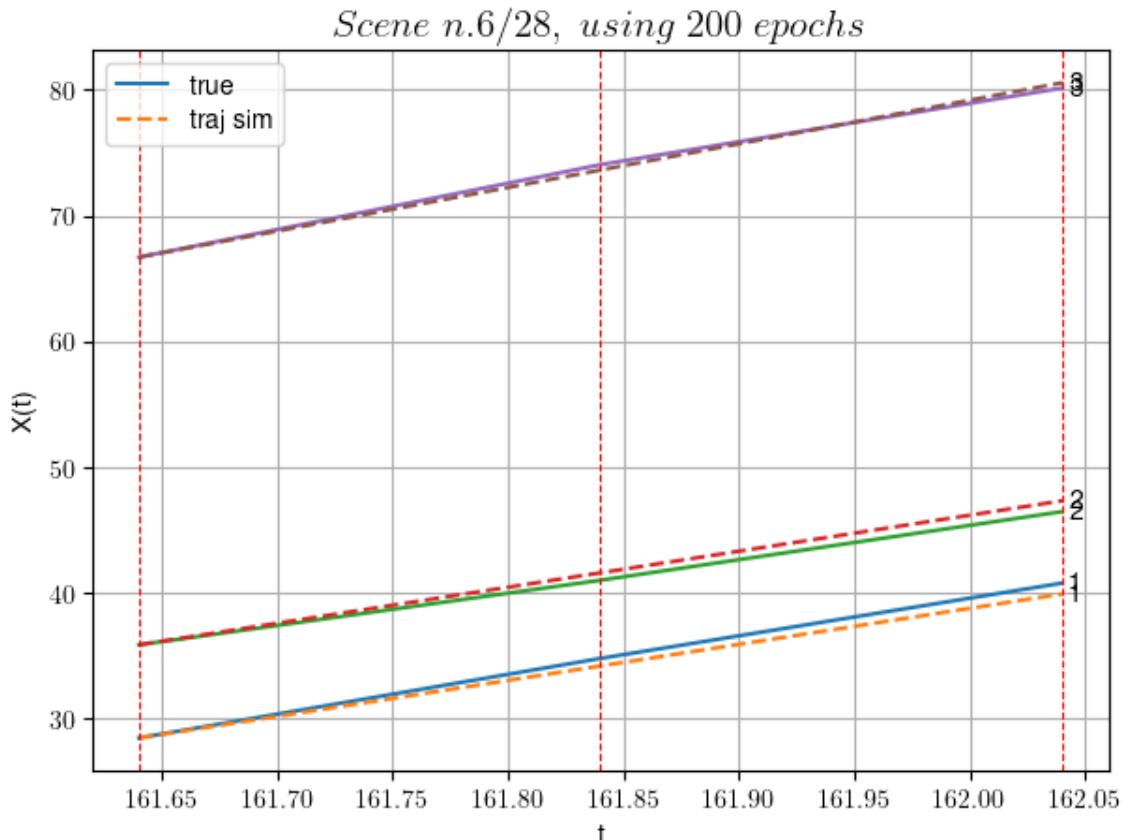
---

---

Scene n.6/28, time interval:[161.64,162.04]

---

---



Loss: 0.2837752361202915  
v0 updated: 34.70664156222626

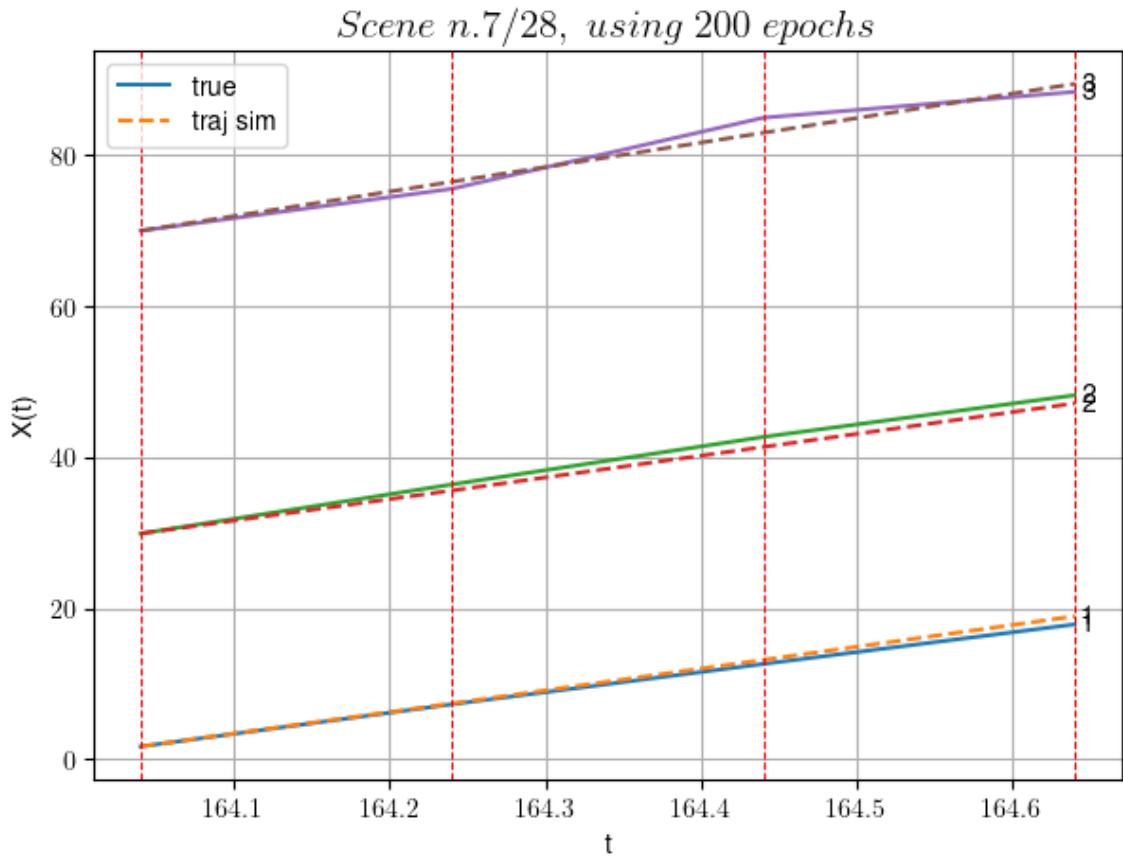
---

---

Scene n.7/28, time interval:[164.04,164.64]

---

---



Loss: 0.9151555496824949  
v0 updated: 32.430179643519104

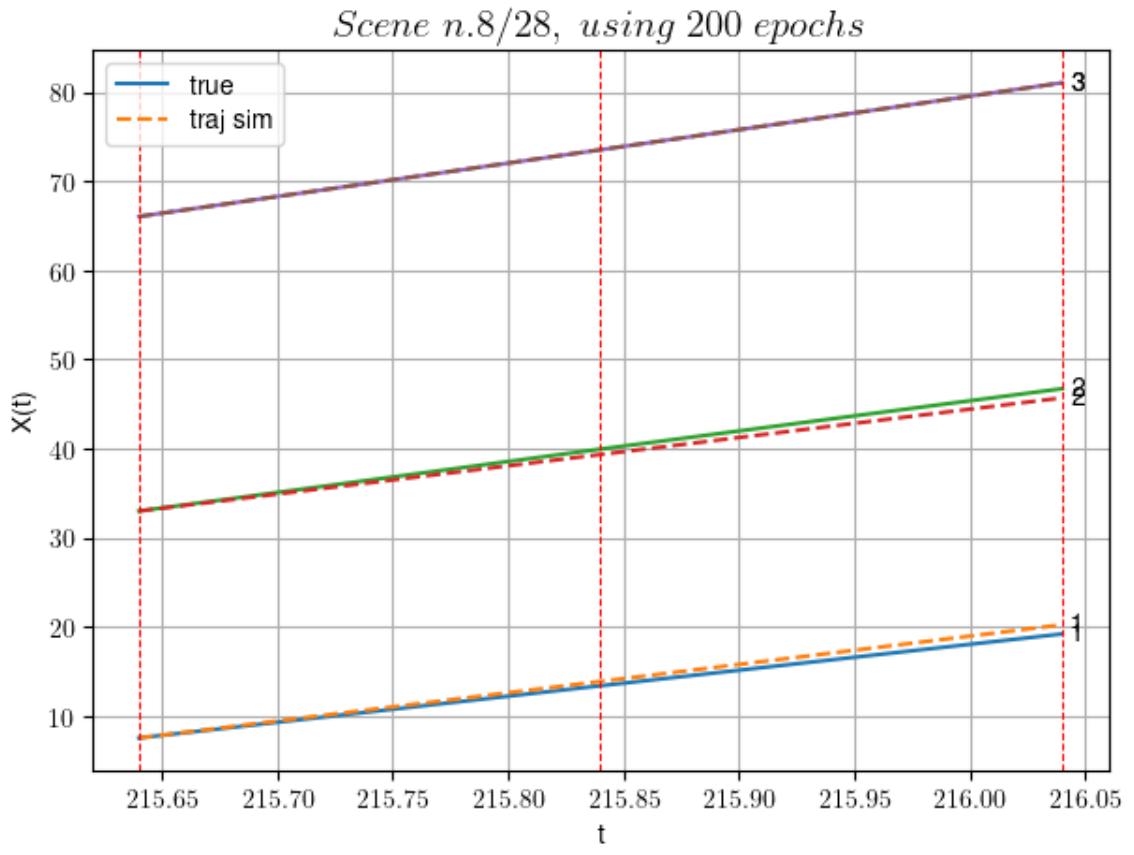
---

---

Scene n.8/28, time interval:[215.64,216.04]

---

---



Loss: 0.302065580810477  
v0 updated: 37.47556118388204

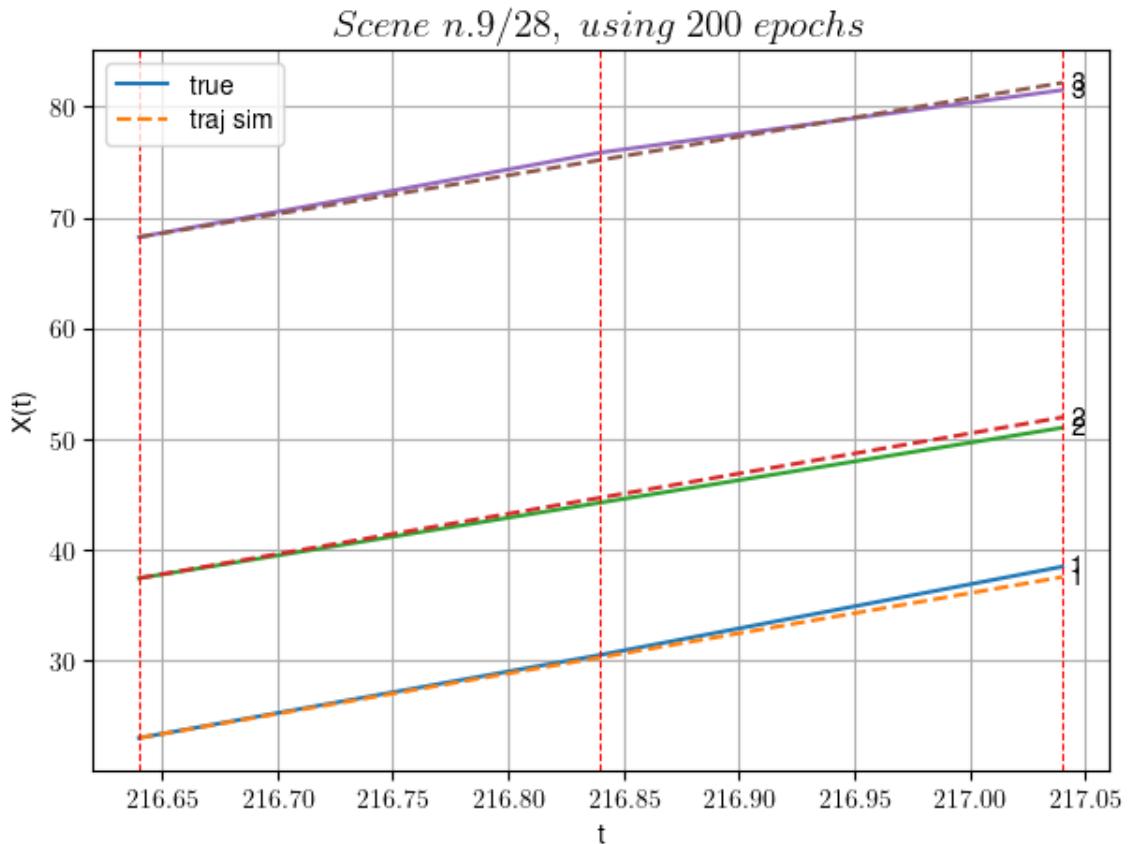
---

---

Scene n.9/28, time interval:[216.64,217.04]

---

---



Loss: 0.3231894646886742  
v0 updated: 34.84649774220546

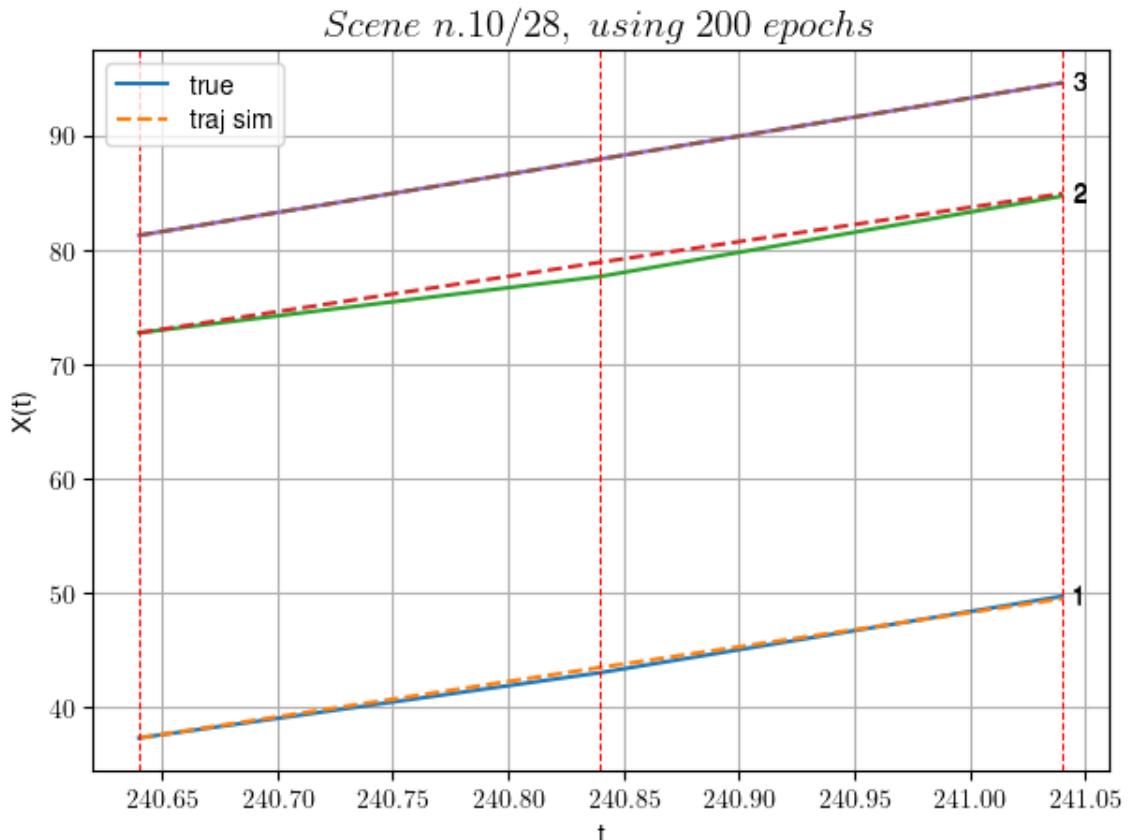
---

---

Scene n.10/28, time interval:[240.64,241.04]

---

---



Loss: 0.20491069866610293  
v0 updated: 33.34109723927839

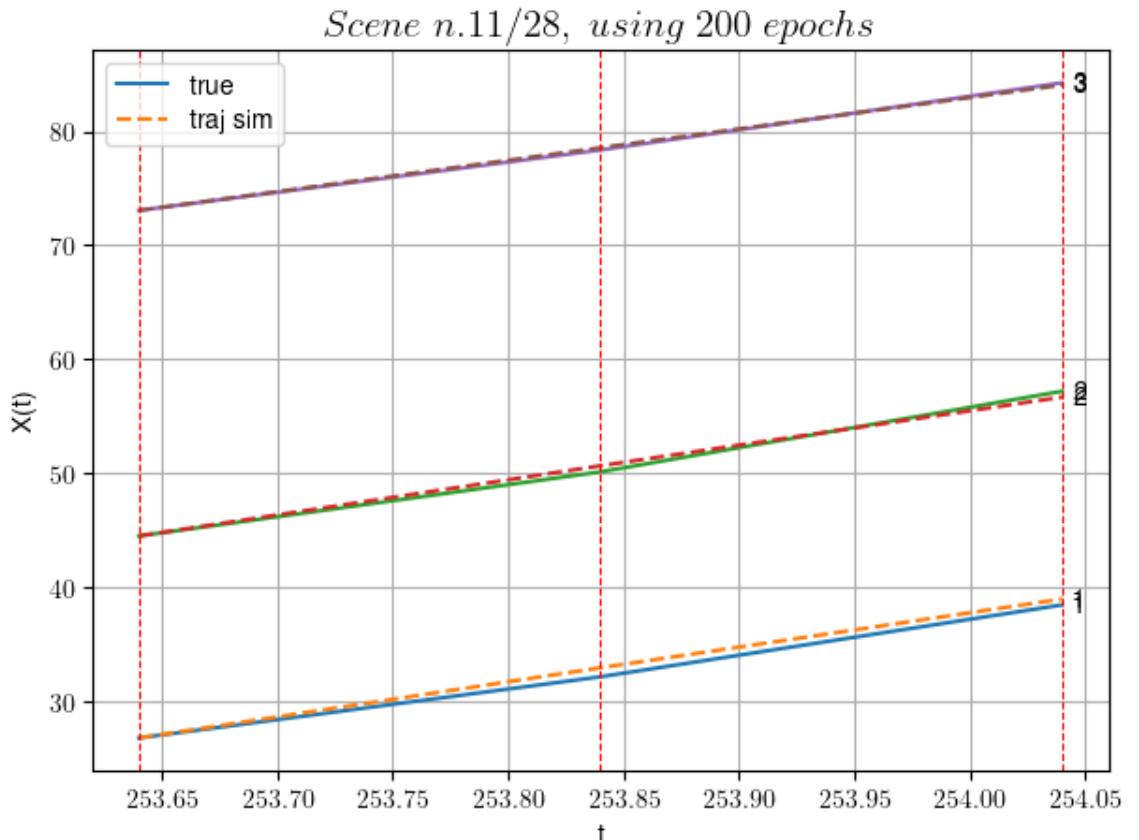
---

---

Scene n.11/28, time interval:[253.64,254.04]

---

---



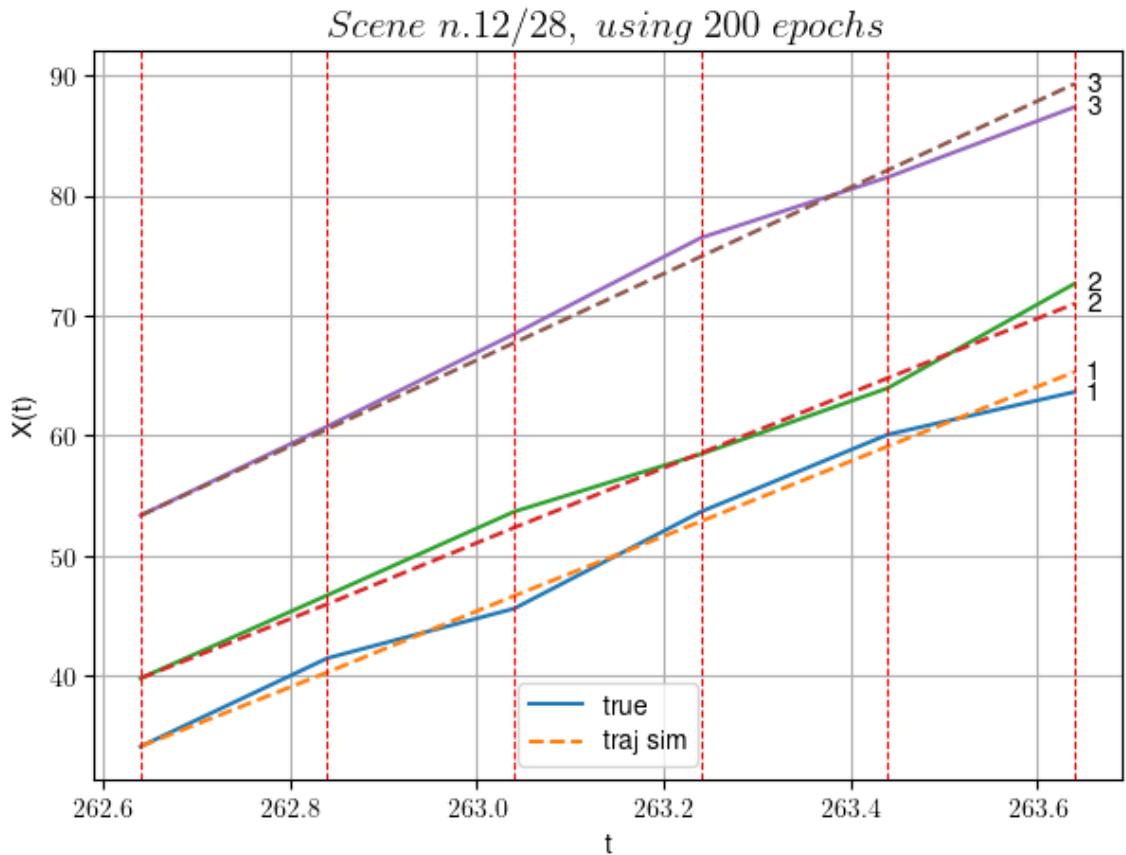
Loss: 0.16907673672324064  
v0 updated: 27.47765219817996

---

---

Scene n.12/28, time interval:[262.64,263.64]

---



Loss: 1.0973169648481684  
v0 updated: 35.92458500353821

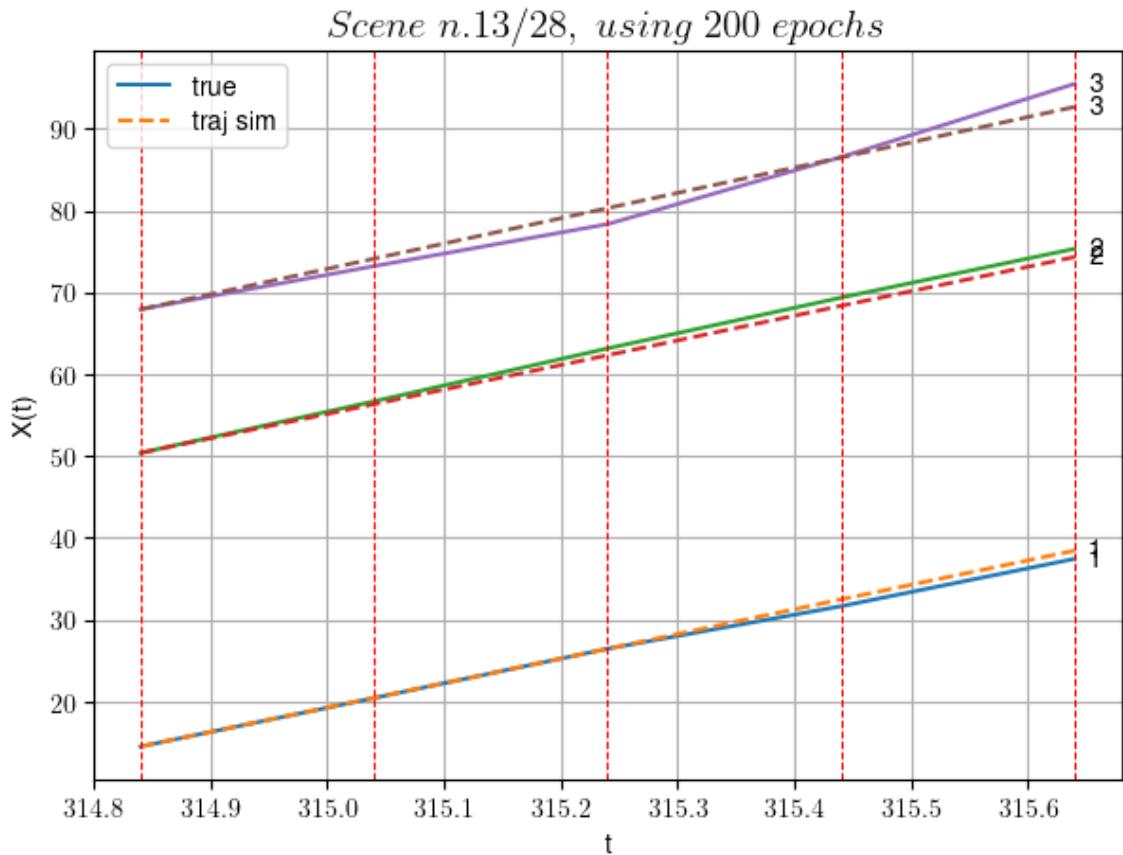
---

---

Scene n.13/28, time interval:[314.84,315.64]

---

---



Loss: 1.144361511143767  
v0 updated: 30.925230826449667

---

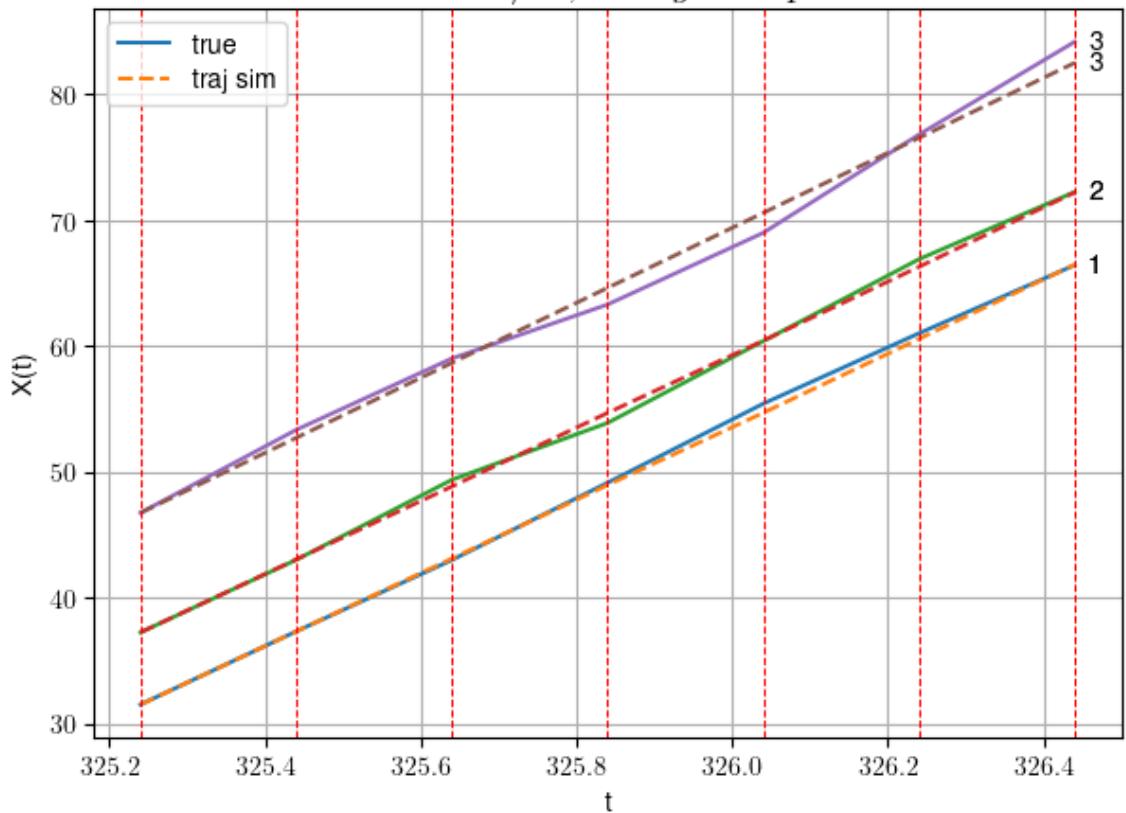
---

Scene n.14/28, time interval:[325.24,326.44]

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---

Scene n.14/28, using 200 epochs

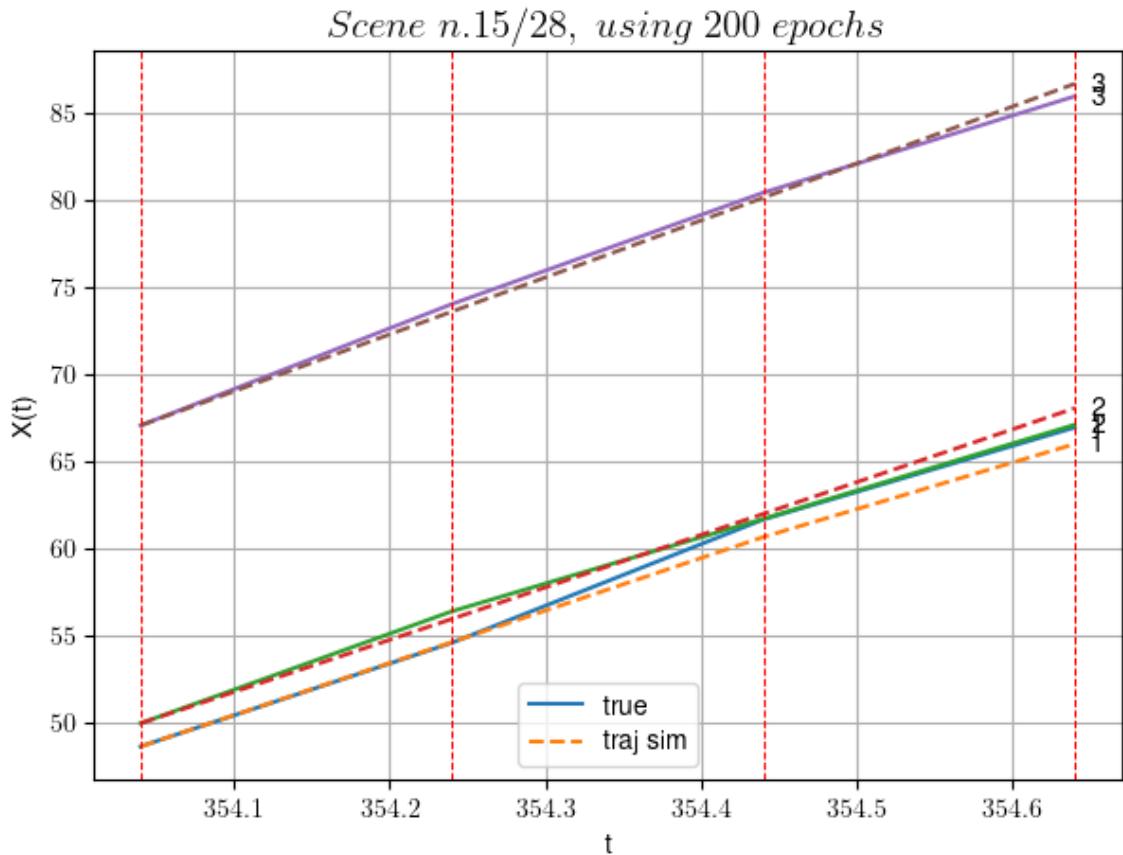


Loss: 0.46231104335713535  
v0 updated: 29.804248983551886

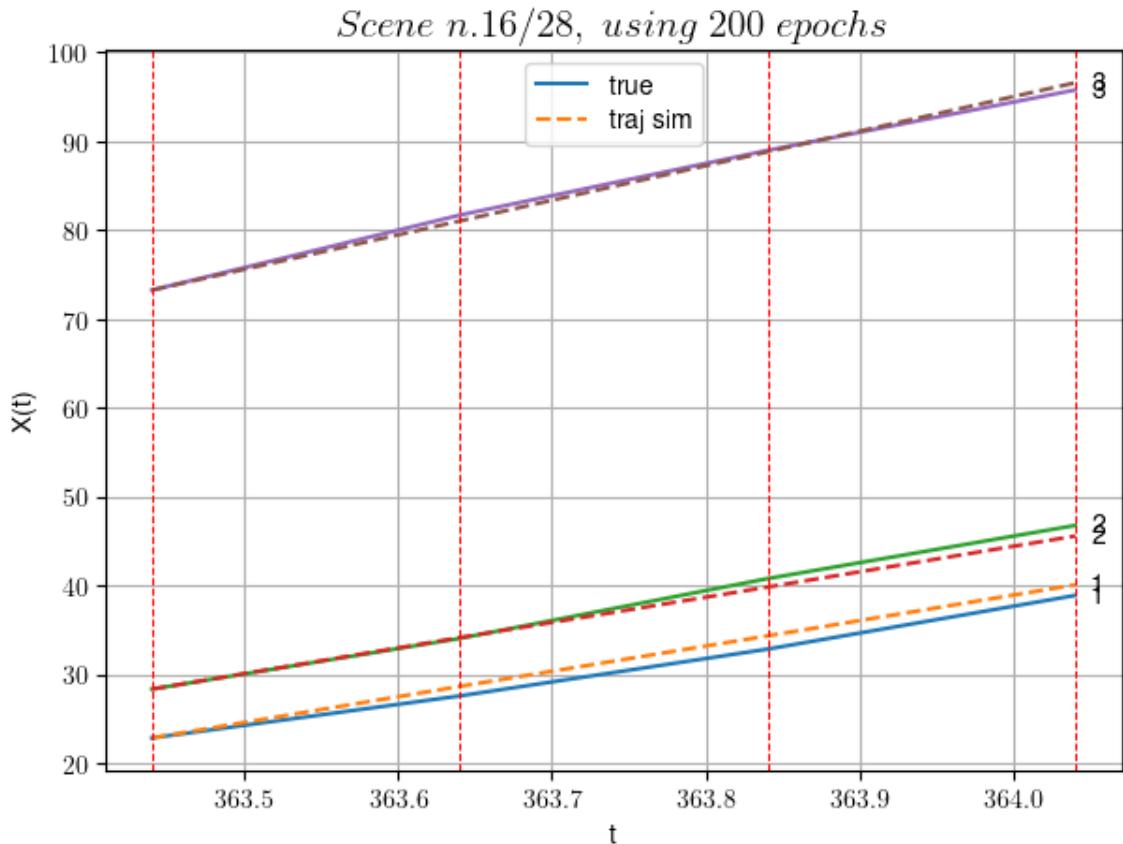
---

Scene n.15/28, time interval:[354.04,354.64]

---



Scene n.16/28, time interval:[363.44,364.04]



Loss: 0.6882973244249807  
v0 updated: 38.91369632733983

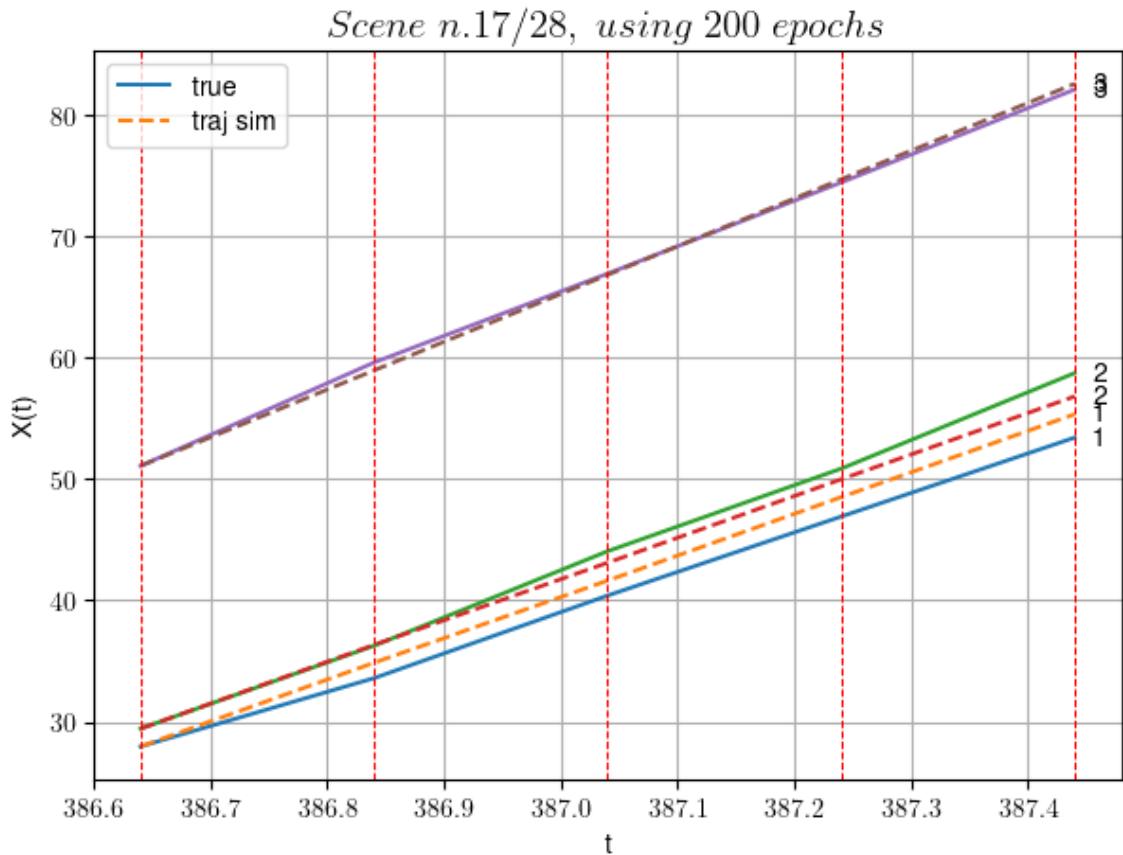
---

---

Scene n.17/28, time interval:[386.64,387.44]

---

---



Loss: 1.0316343551748428  
v0 updated: 39.335838025232285

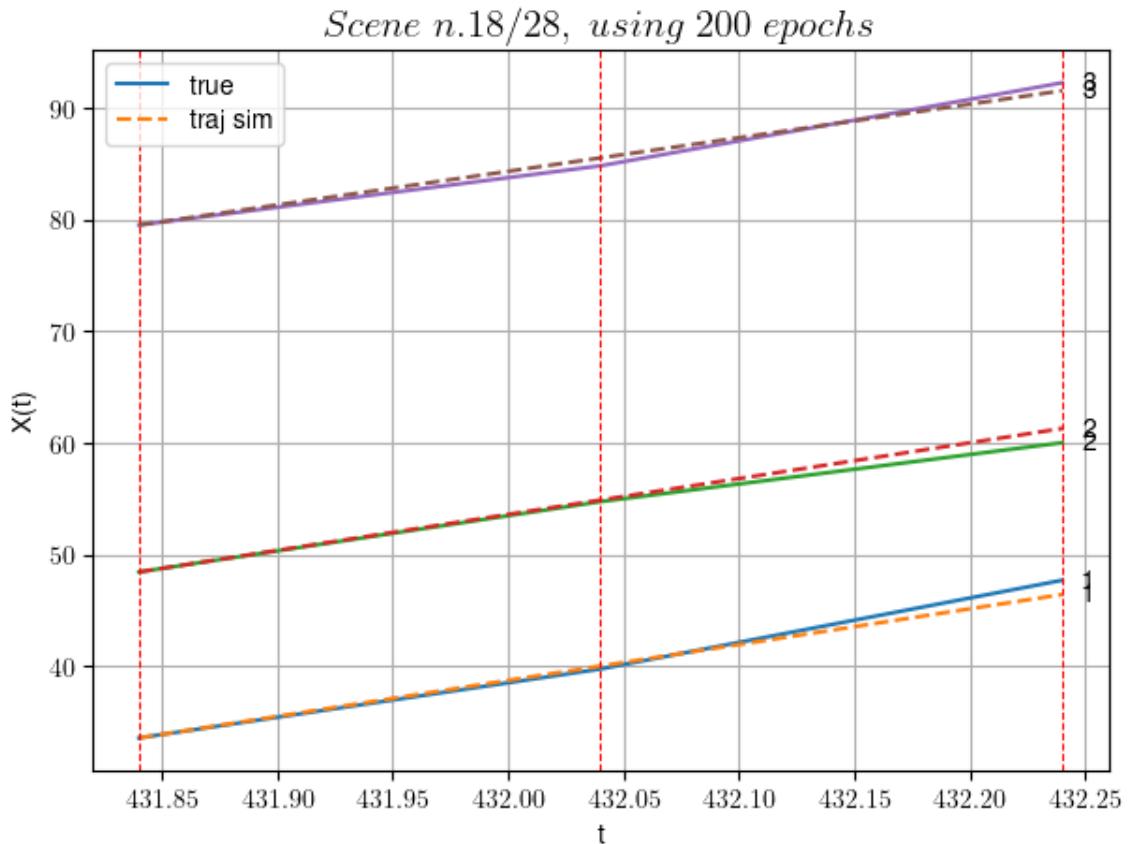
---

---

Scene n.18/28, time interval:[431.84,432.24]

---

---



Loss: 0.48418411872152783  
v0 updated: 30.08406922558775

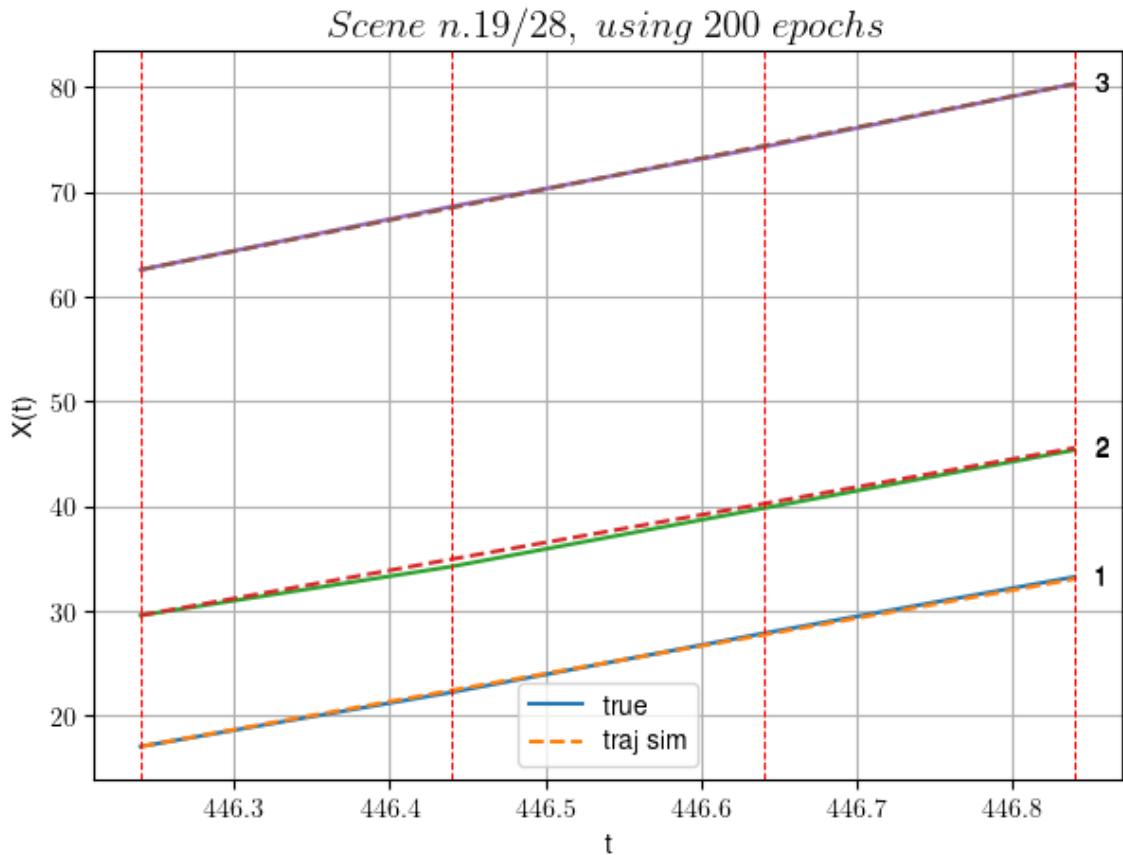
---

---

Scene n.19/28, time interval:[446.24,446.84]

---

---



Loss: 0.07127288365760241  
v0 updated: 29.554918451780917

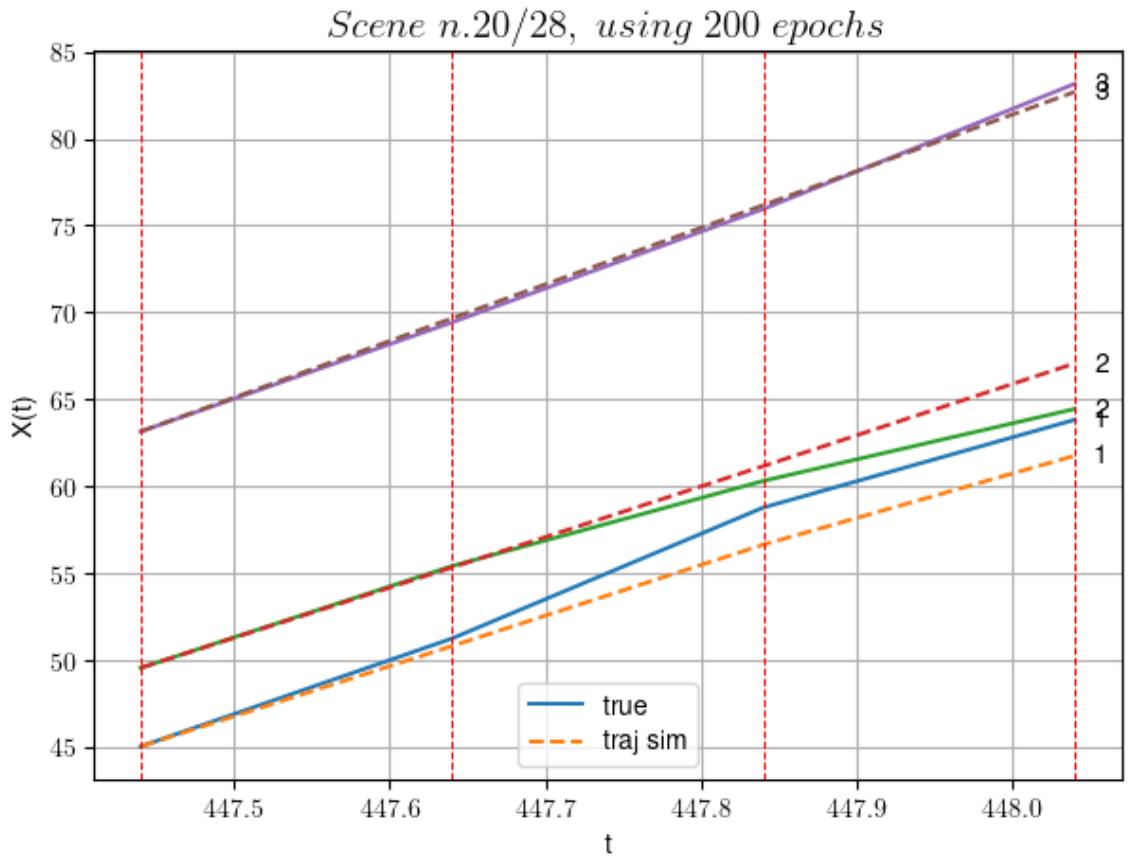
---

---

Scene n.20/28, time interval:[447.44,448.04]

---

---



Loss: 1.412817053850867  
v0 updated: 32.58202183444173

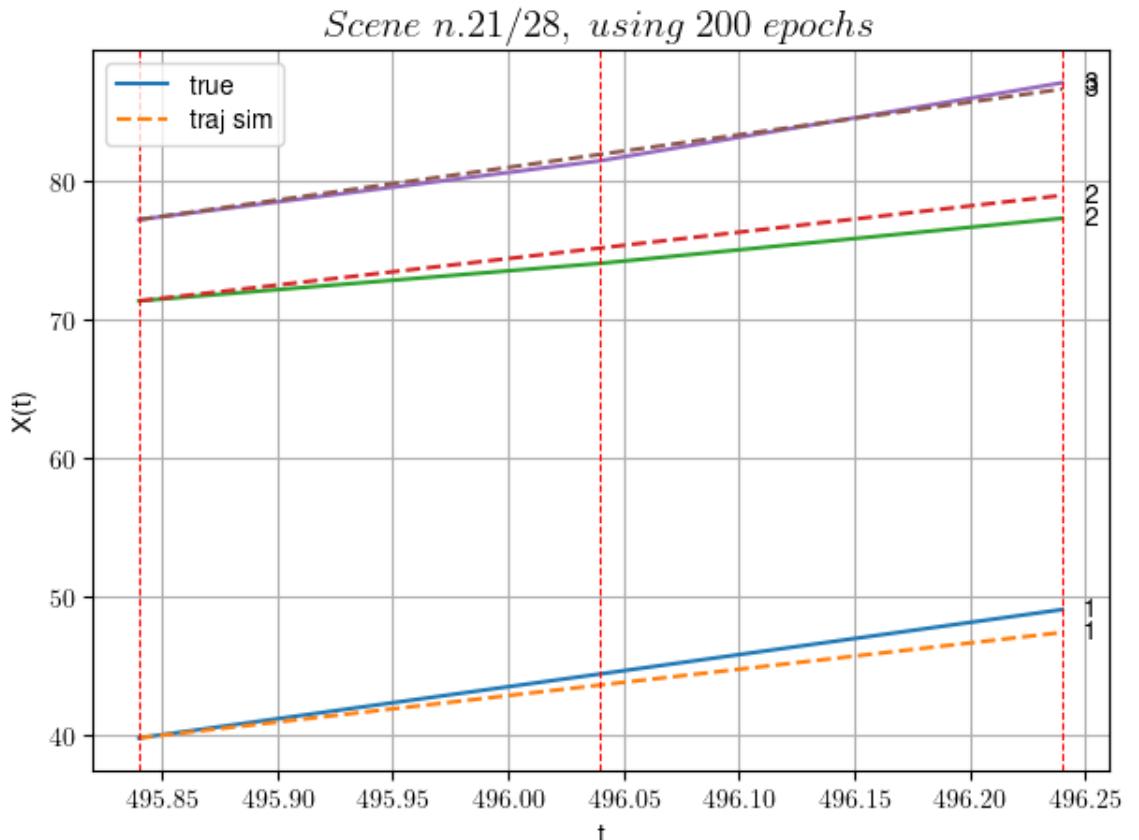
---

---

Scene n.21/28, time interval:[495.84,496.24]

---

---



Loss: 0.8615118346848488  
v0 updated: 23.57016129990174

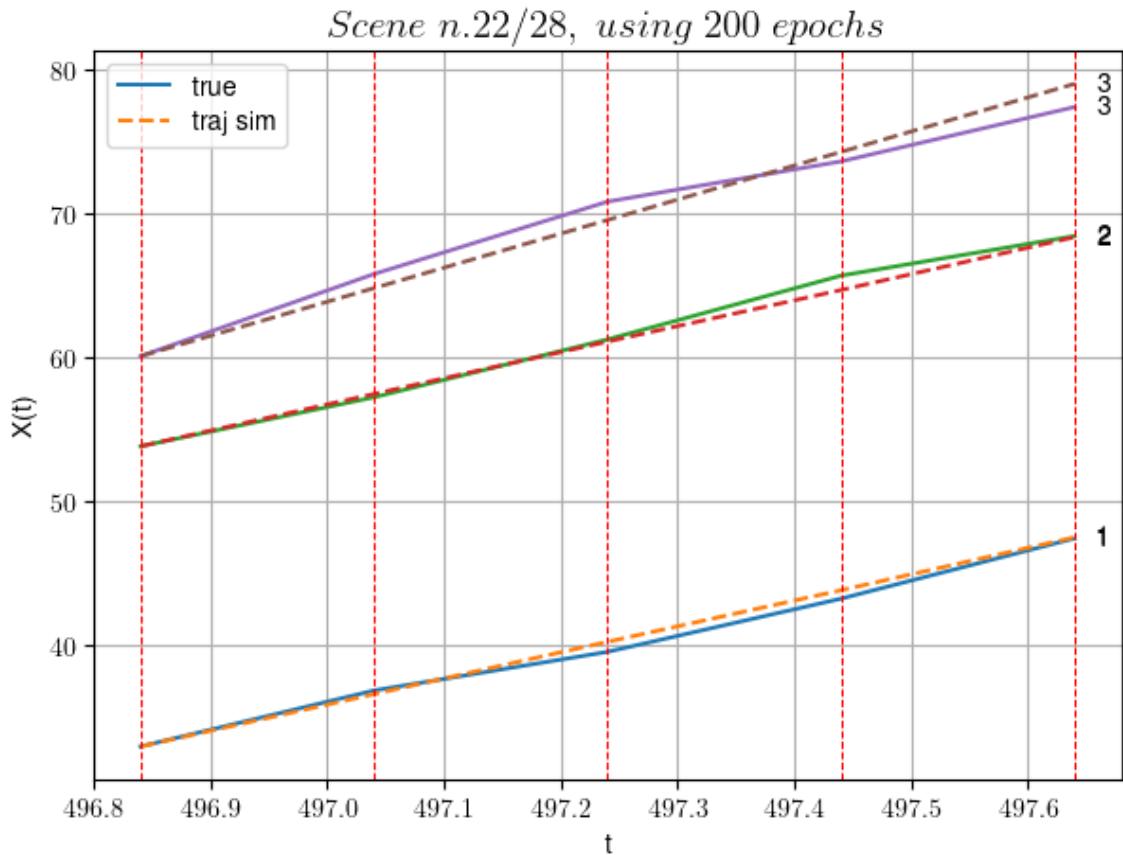
---

---

Scene n.22/28, time interval:[496.84,497.64]

---

---



Loss: 0.5072544075325244  
v0 updated: 23.677971432065316

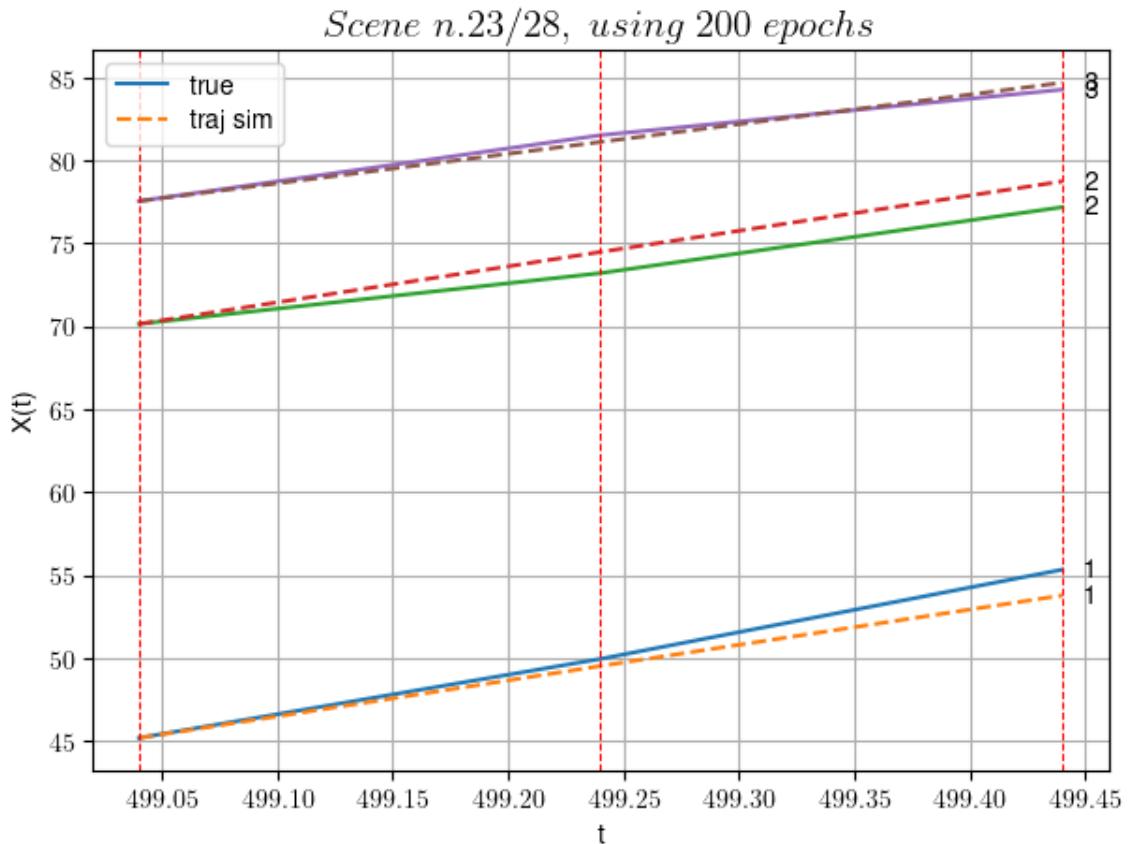
---

---

Scene n.23/28, time interval:[499.04,499.44]

---

---



Loss: 0.7756512370812844  
v0 updated: 17.84552396355751

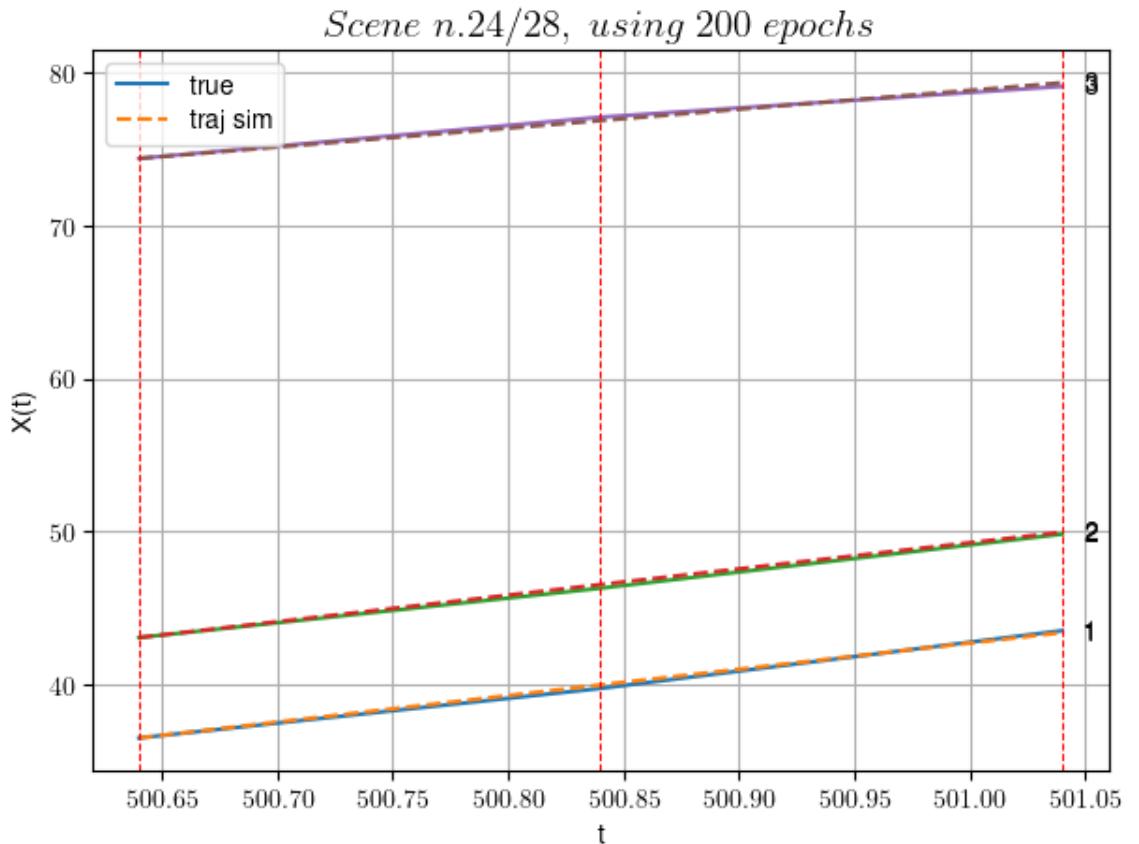
---

---

Scene n.24/28, time interval:[500.64,501.04]

---

---



Loss: 0.028114066114516473  
v0 updated: 12.380737668981242

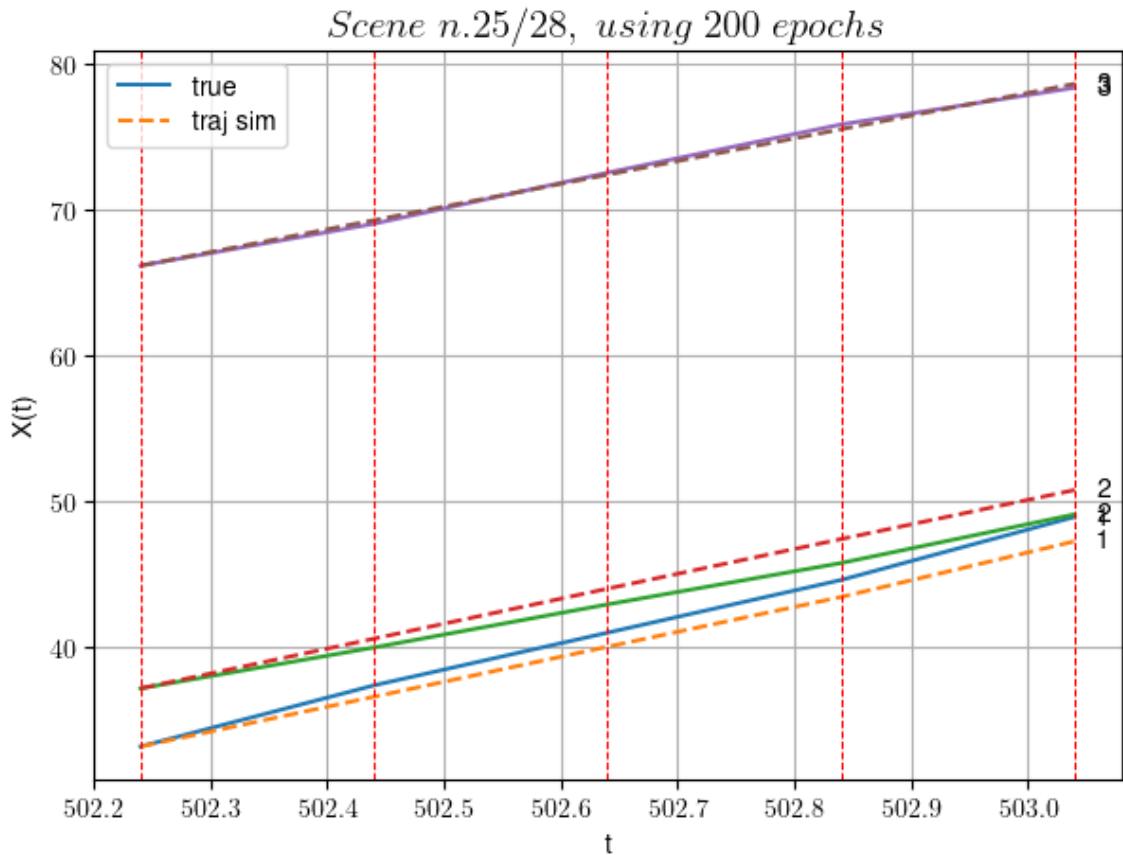
---

---

Scene n.25/28, time interval:[502.24,503.04]

---

---



Loss: 0.8662225283446388  
v0 updated: 15.59684895850361

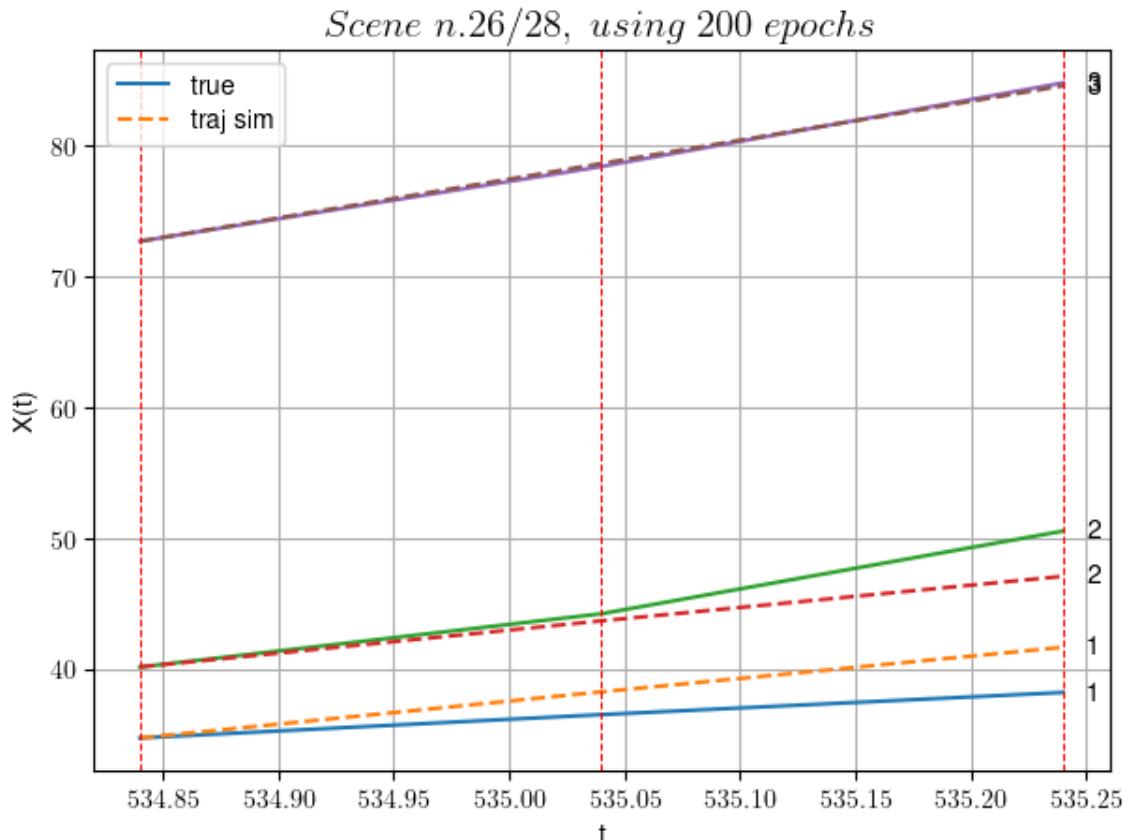
---

---

Scene n.26/28, time interval:[534.84,535.24]

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---

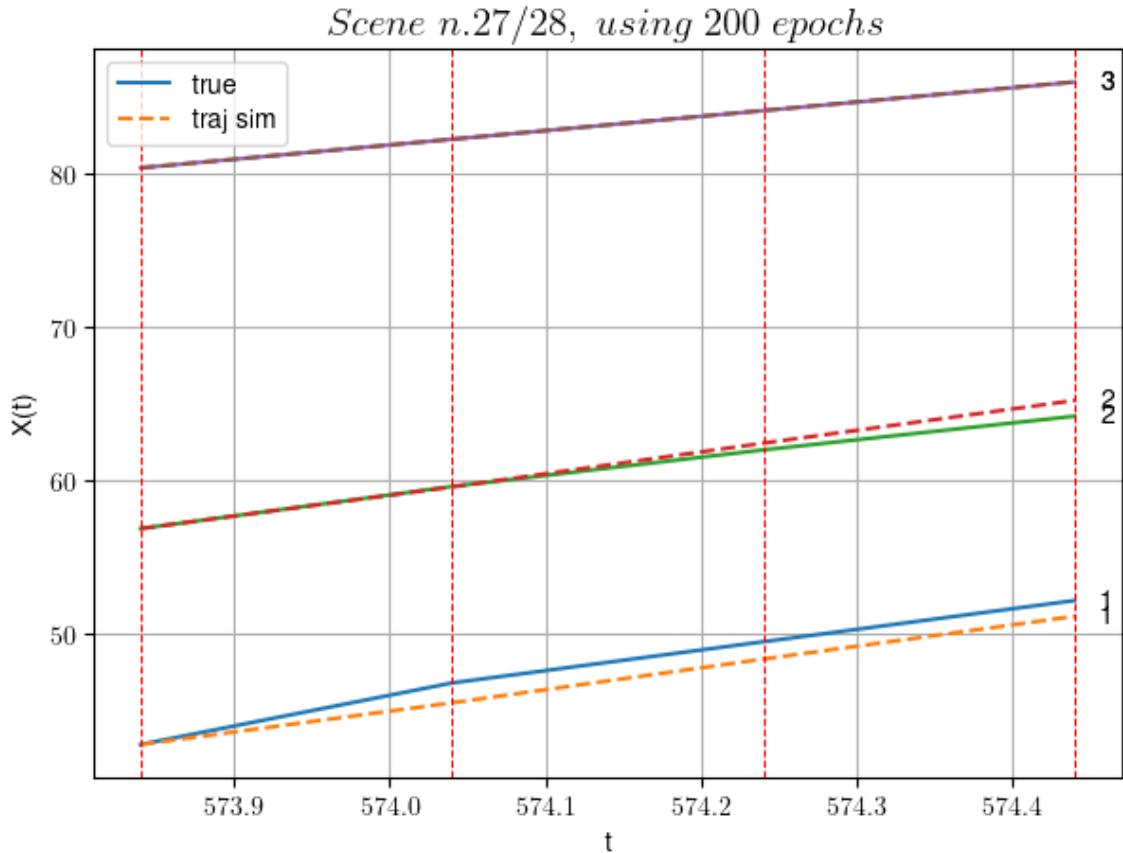


Loss: 3.0435613296624466  
v0 updated: 29.753753037486266

---

Scene n.27/28, time interval:[573.84,574.44]

---



```
v0_mean in this df is: 28.932693265541552
Time taken: 138.15s
Hidden-Layer-1/kernel:0:      [-9.3273382e+00 -5.4357295e+00 -1.
2637139e+05 -6.0159552e+02]
Hidden-Layer-1/bias:0:      [ 3.1018731e-01  6.8538828e+00 -6.2534644
e+03 -3.4169199e+02]
Output-Layer/kernel:0:      [-5.2579060e+00  2.3318329e+00 -1.5931100
e+05  1.4249943e+01]
Output-Layer/bias:0:      [13.606243]
```

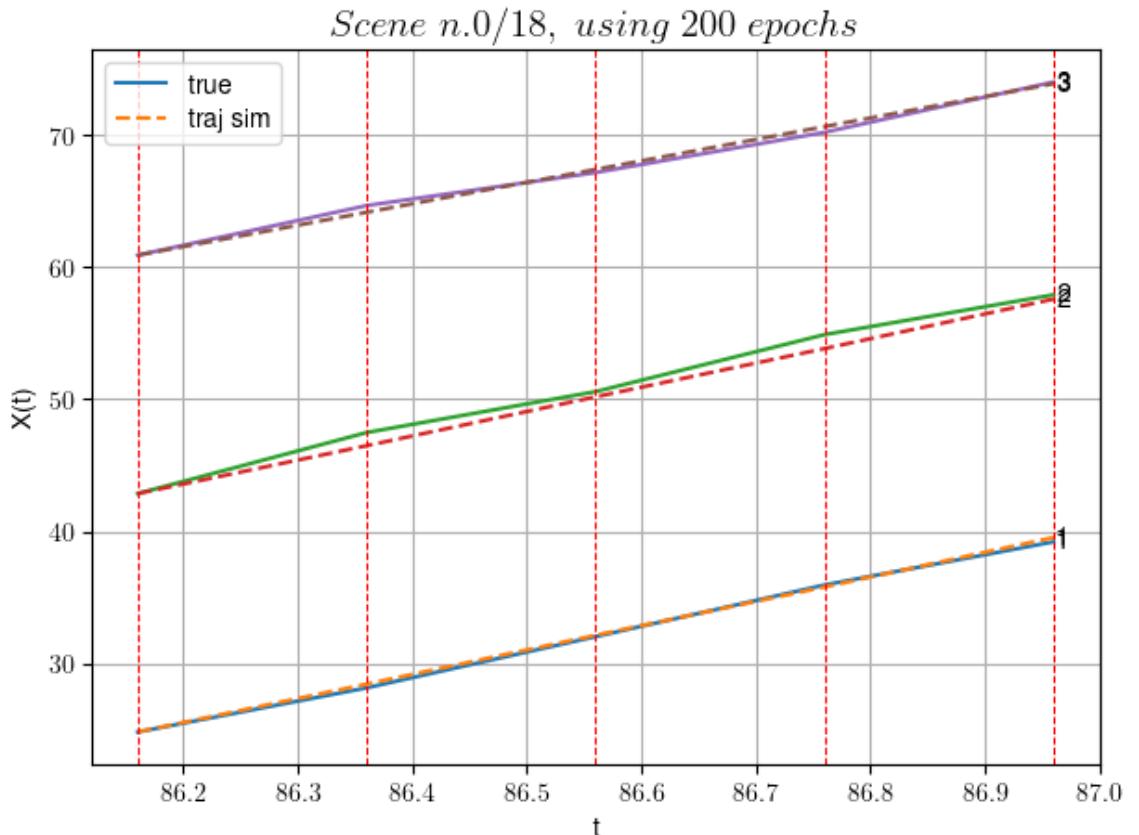
---

```
In df n.2/10 we have 18 scenes
```

---

```
Scene n.0/18, time interval:[86.16,86.96]
```

---



Loss: 0.20828001171308383  
v0 updated: 16.25044385096199

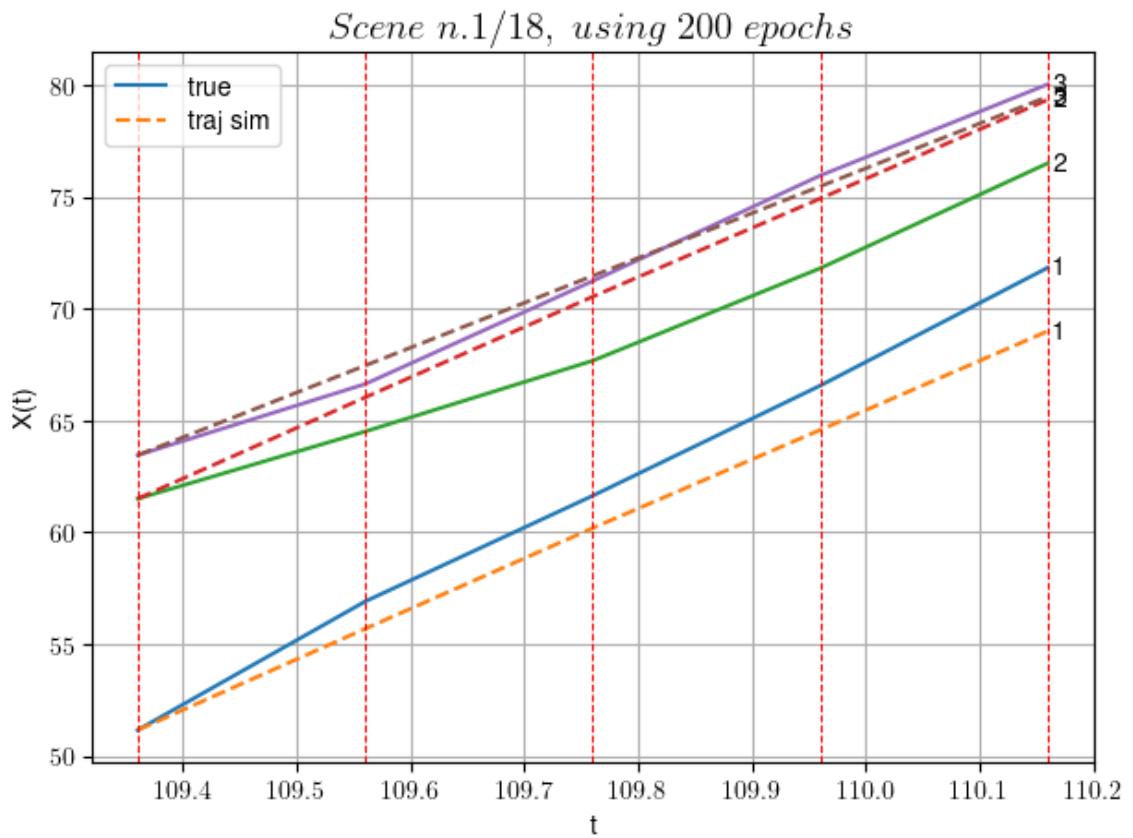
---

---

Scene n.1/18, time interval:[109.36,110.16]

---

---



Loss: 3.012238467904387  
v0 updated: 20.044801660133654

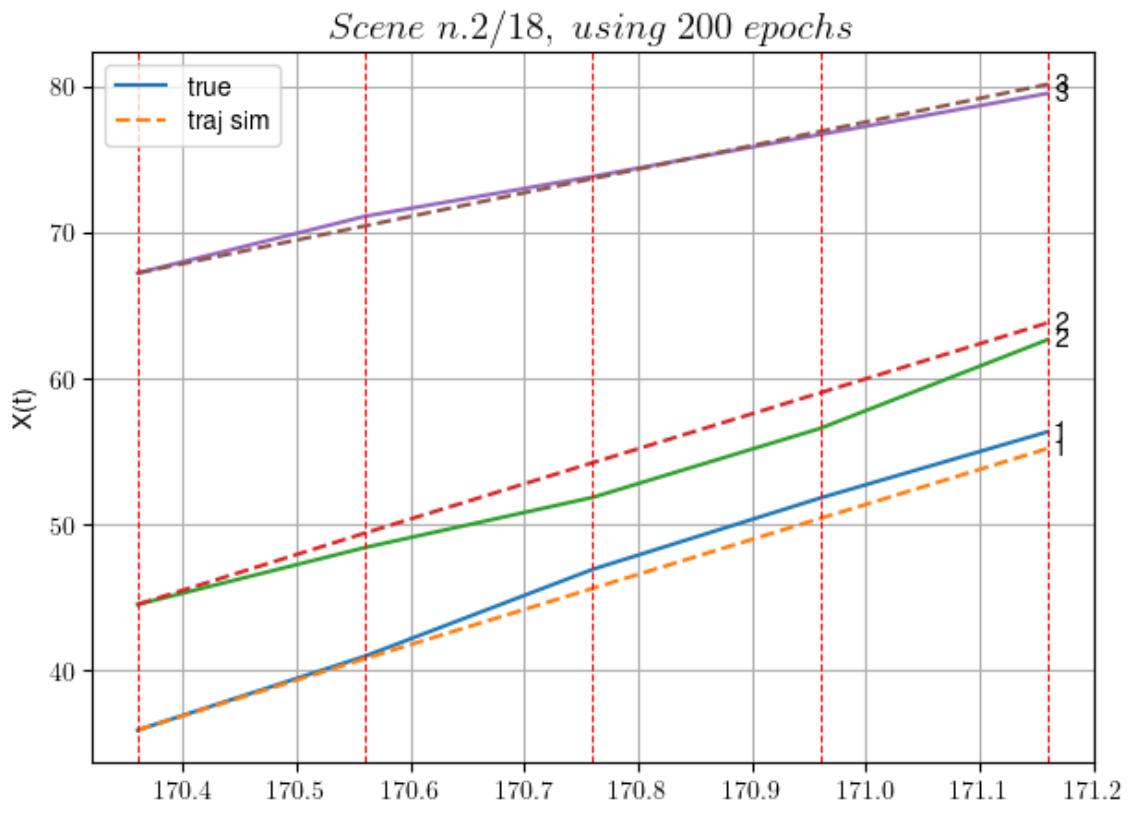
---

---

Scene n.2/18, time interval:[170.36,171.16]

---

---



Loss: 1.3181672877937032  
v0 updated: 16.166815108702973

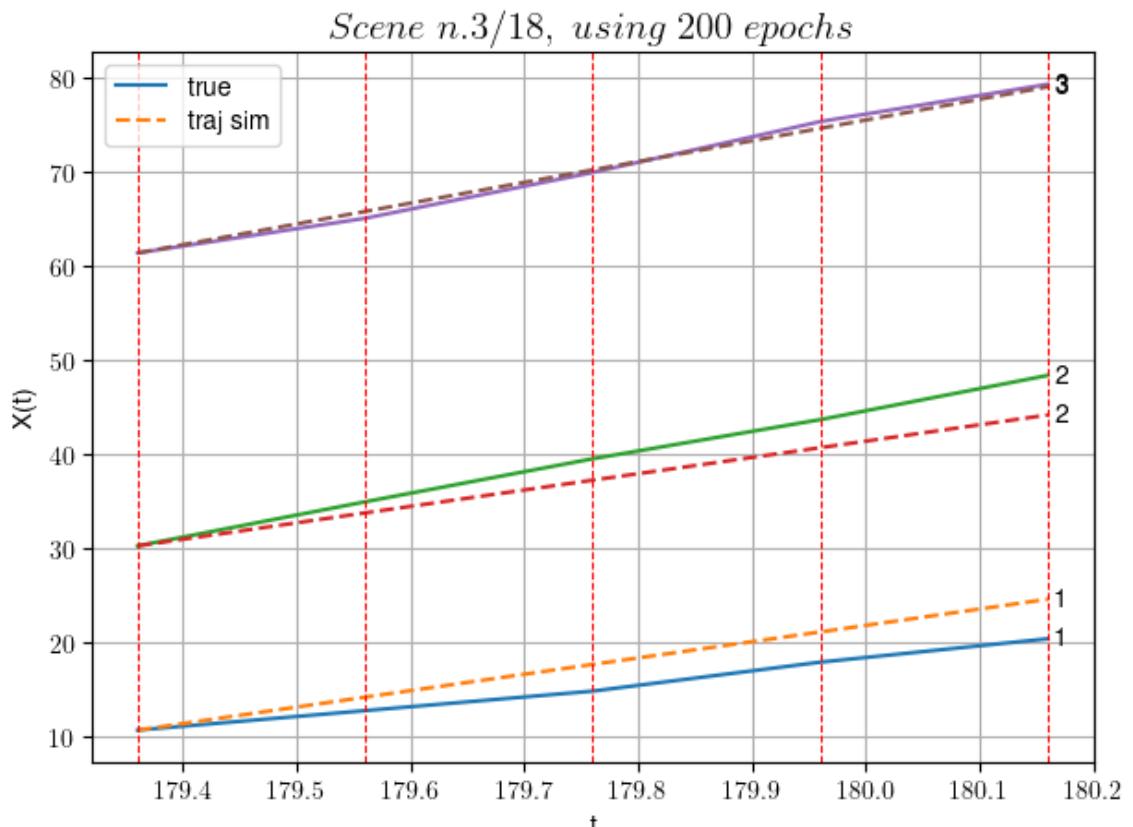
---

---

Scene n.3/18, time interval:[179.36,180.16]

---

---



Loss: 4.83559825068946  
v0 updated: 22.09069359979243

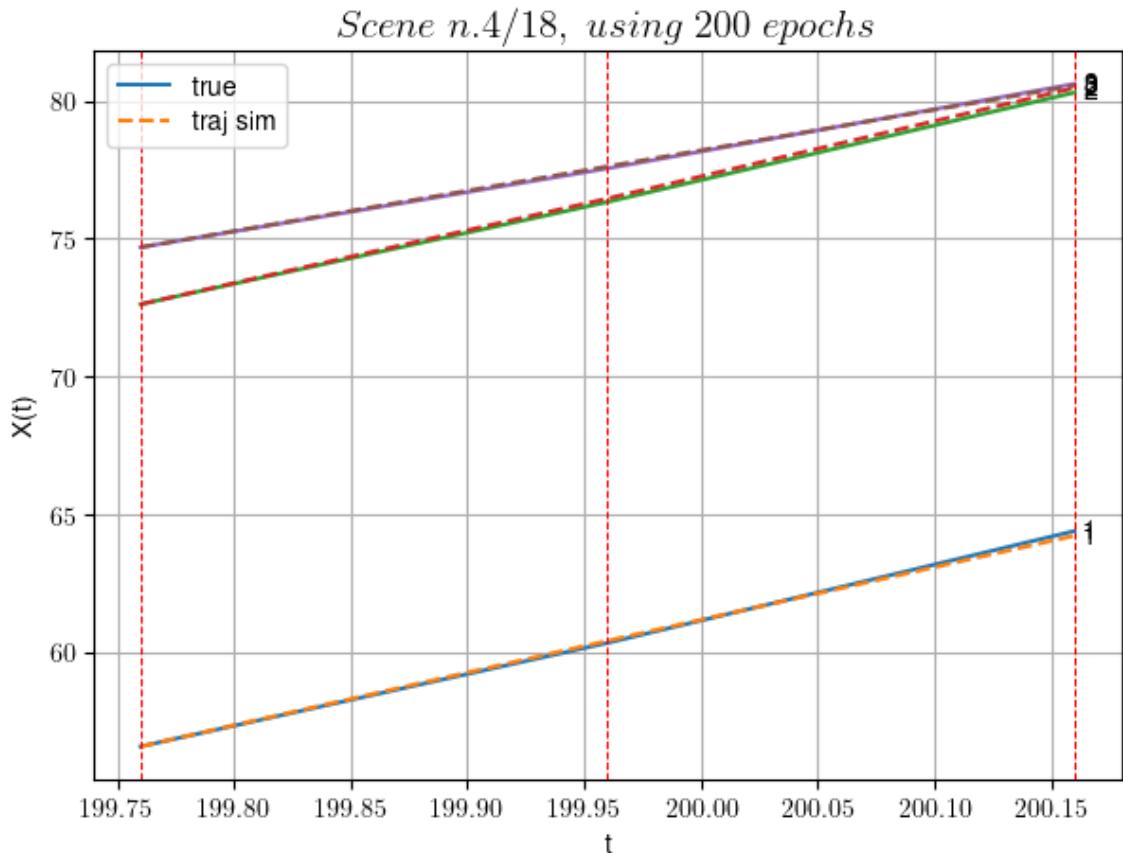
---

---

Scene n.4/18, time interval:[199.76,200.16]

---

---



Loss: 0.009827407087024622  
v0 updated: 14.668522634721668

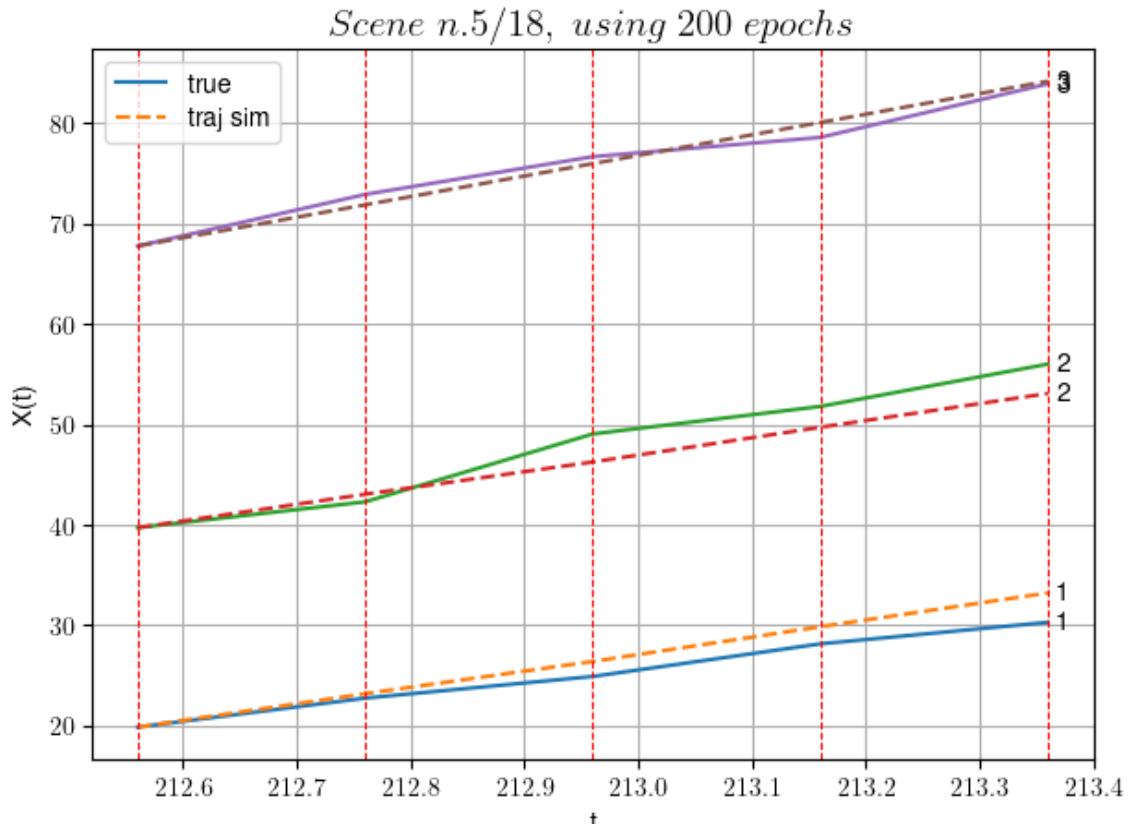
---

---

Scene n.5/18, time interval:[212.56,213.36]

---

---



Loss: 2.5984316938181666  
v0 updated: 20.517558612694323

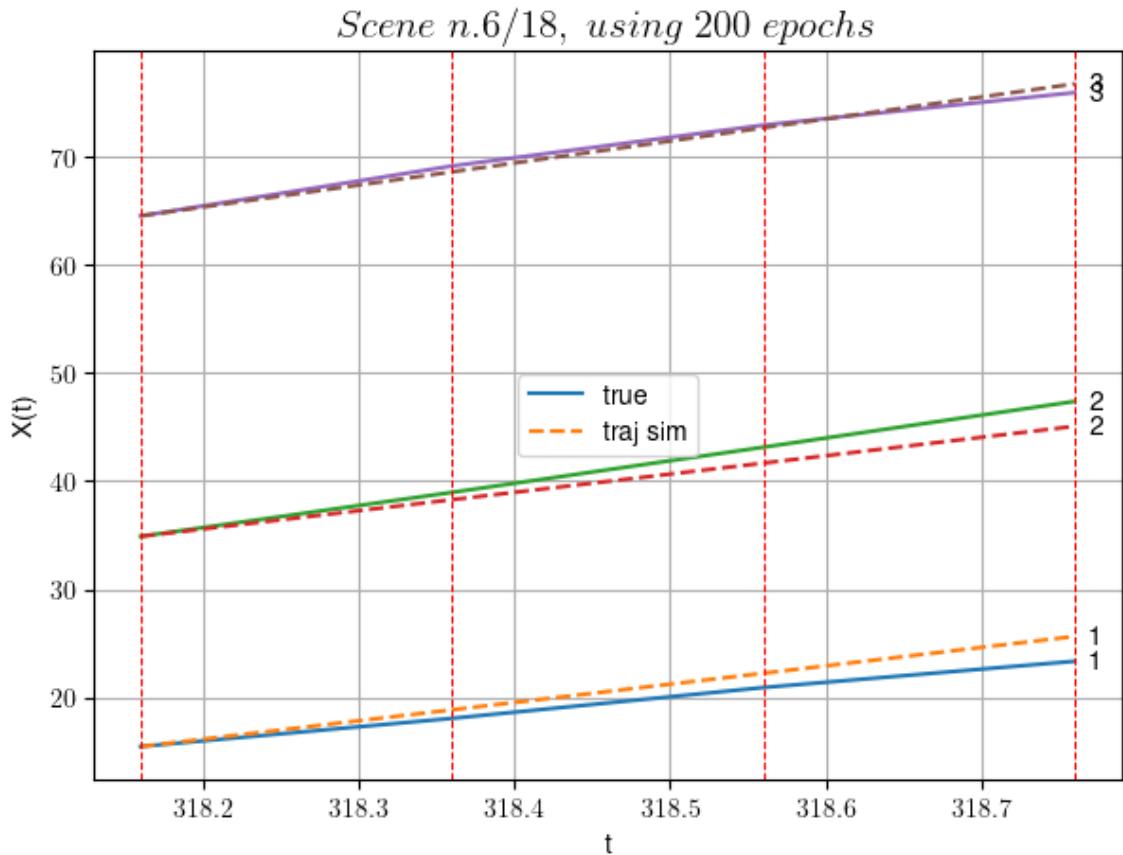
---

---

Scene n.6/18, time interval:[318.16,318.76]

---

---



Loss: 1.3841498736367717  
v0 updated: 20.365787750550588

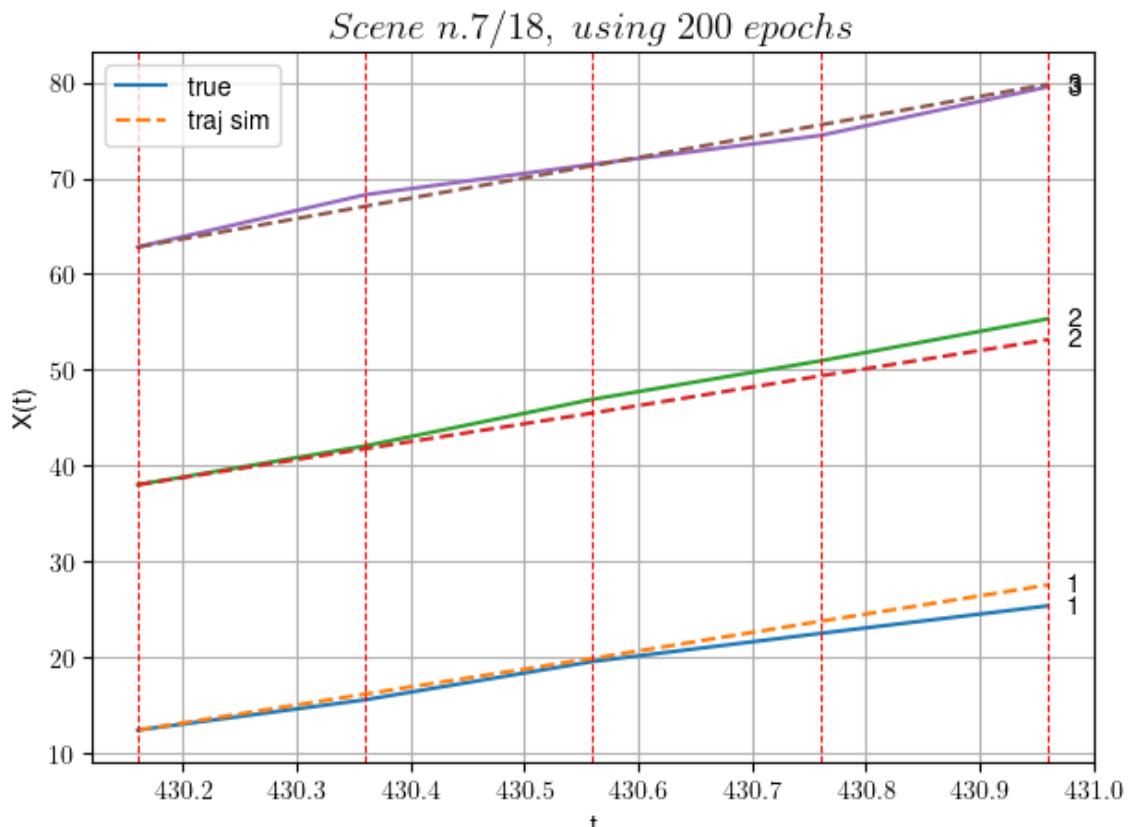
---

---

Scene n.7/18, time interval:[430.16,430.96]

---

---



Loss: 1.2595752219635155  
v0 updated: 21.24652473815916

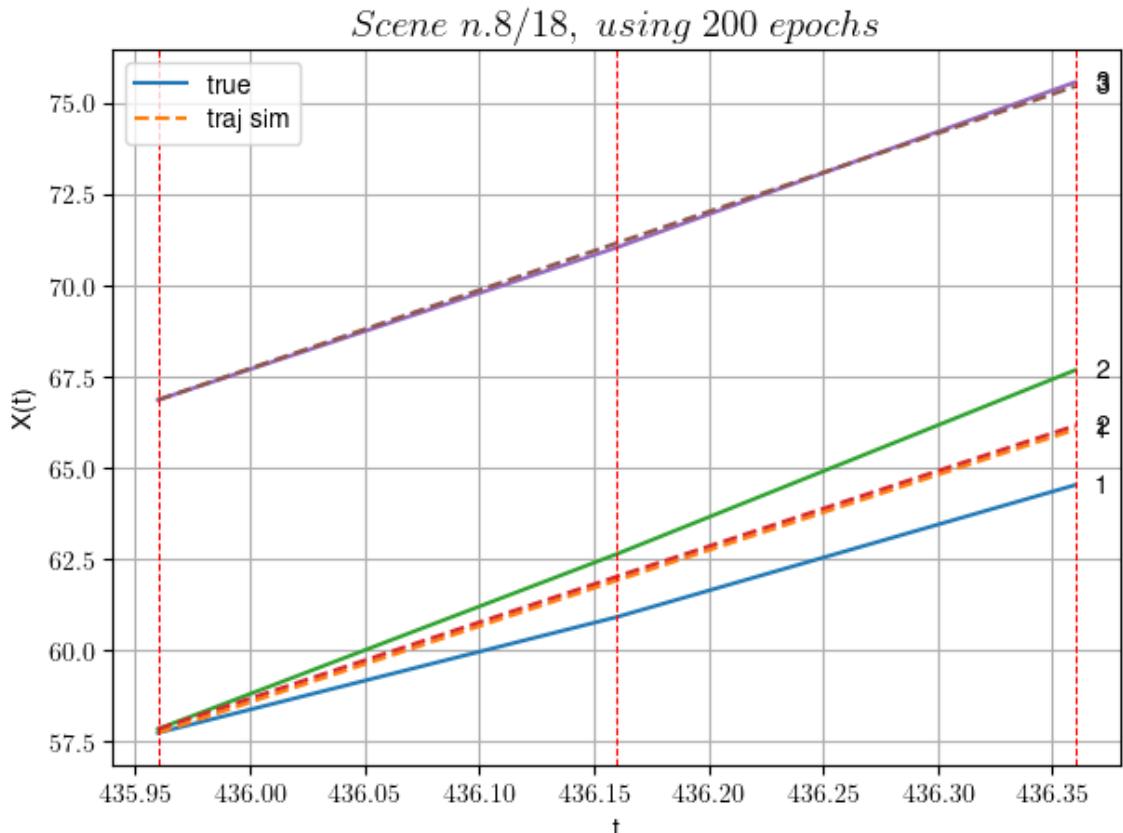
---

---

Scene n.8/18, time interval:[435.96, 436.36]

---

---



Loss: 0.6717598379269804  
v0 updated: 21.46809393658992

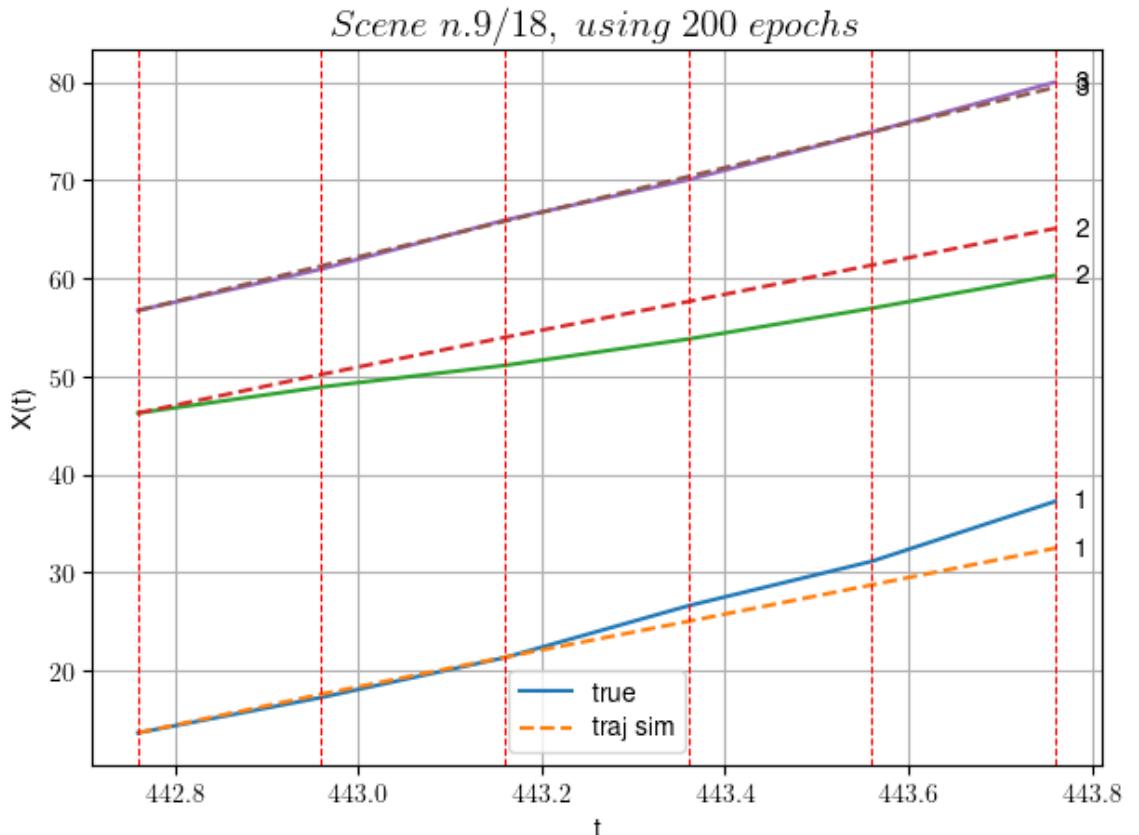
---

---

Scene n.9/18, time interval:[442.76,443.76]

---

---



Loss: 5.474290616104508  
v0 updated: 22.78382896397465

---

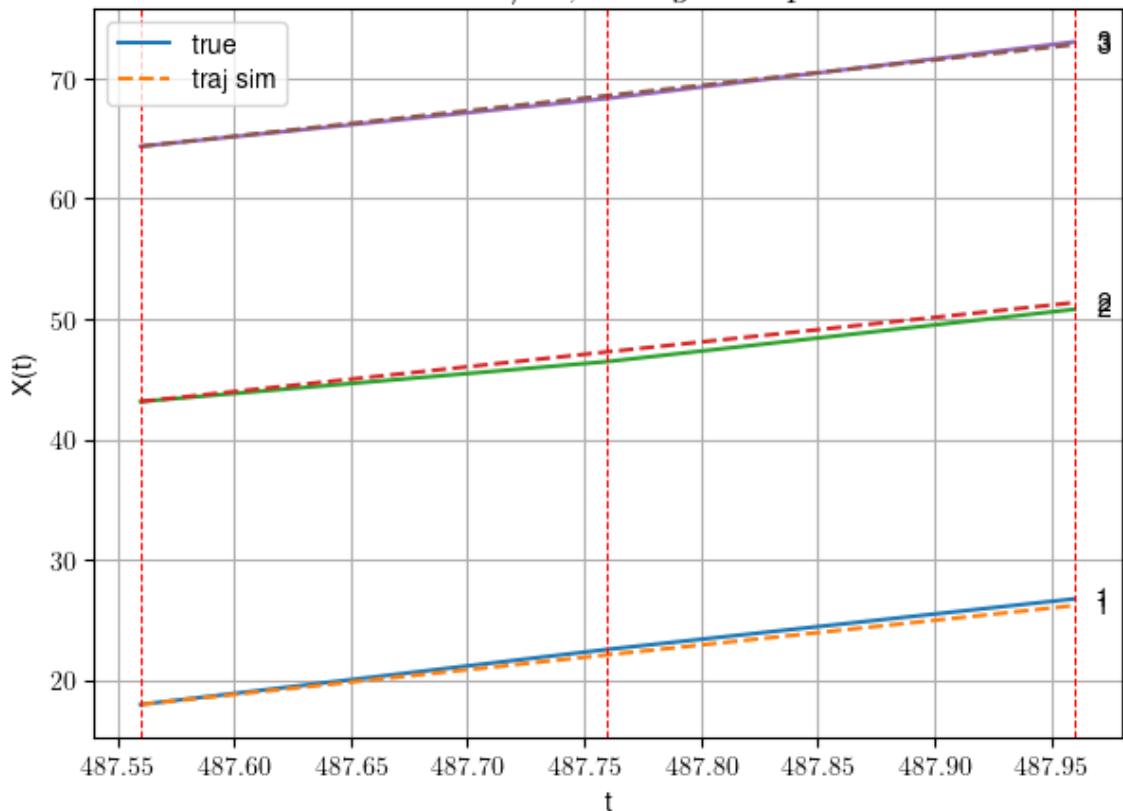
---

Scene n.10/18, time interval:[487.56,487.96]

---

---

Scene n.10/18, using 200 epochs

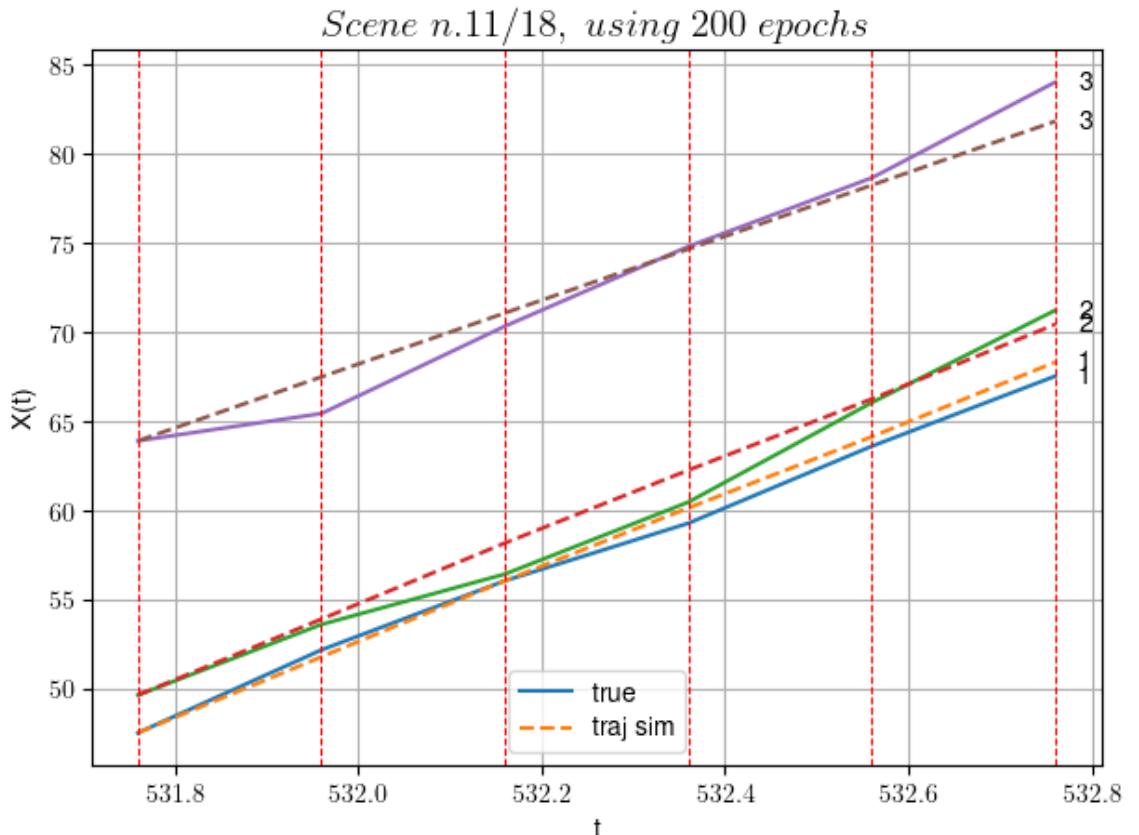


Loss: 0.177005984282255  
v0 updated: 21.121659499827274

---

Scene n.11/18, time interval:[531.76,532.76]

---



Loss: 1.0324522658754525  
v0 updated: 17.925004407991814

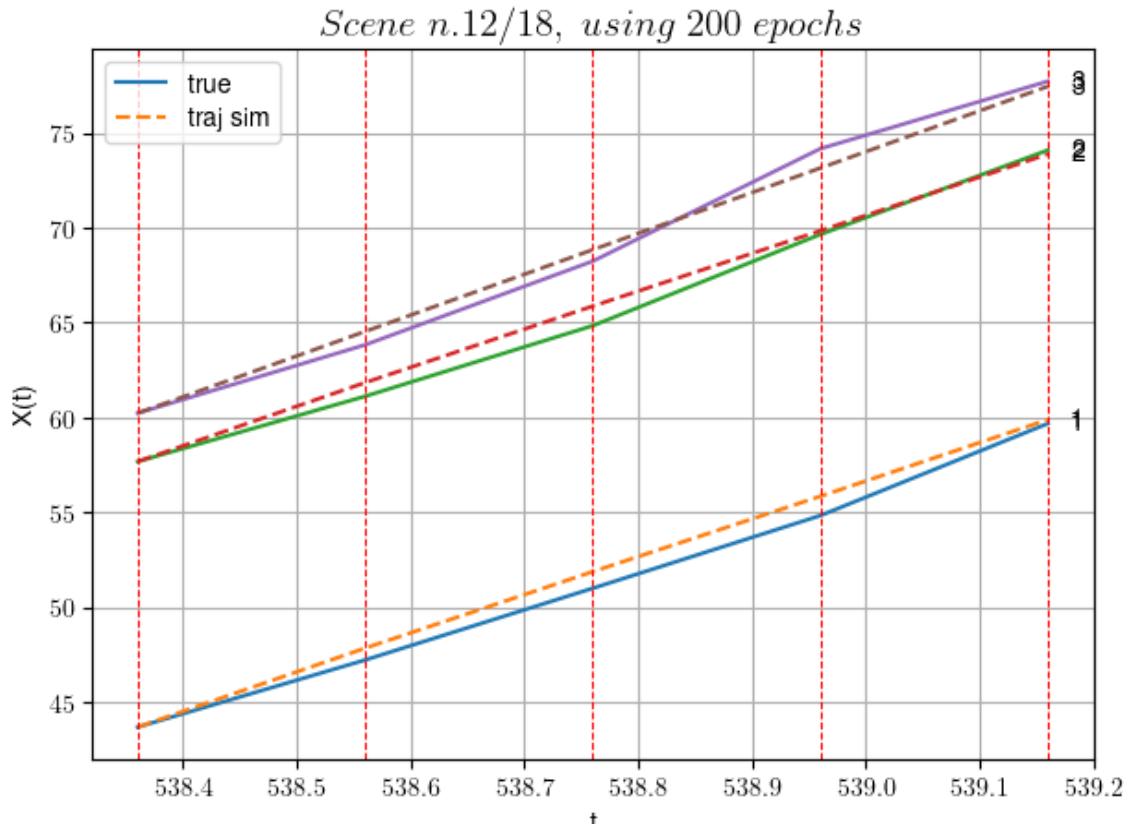
---

---

Scene n.12/18, time interval:[538.36,539.16]

---

---



Loss: 0.39122765425387085  
v0 updated: 21.528181738872128

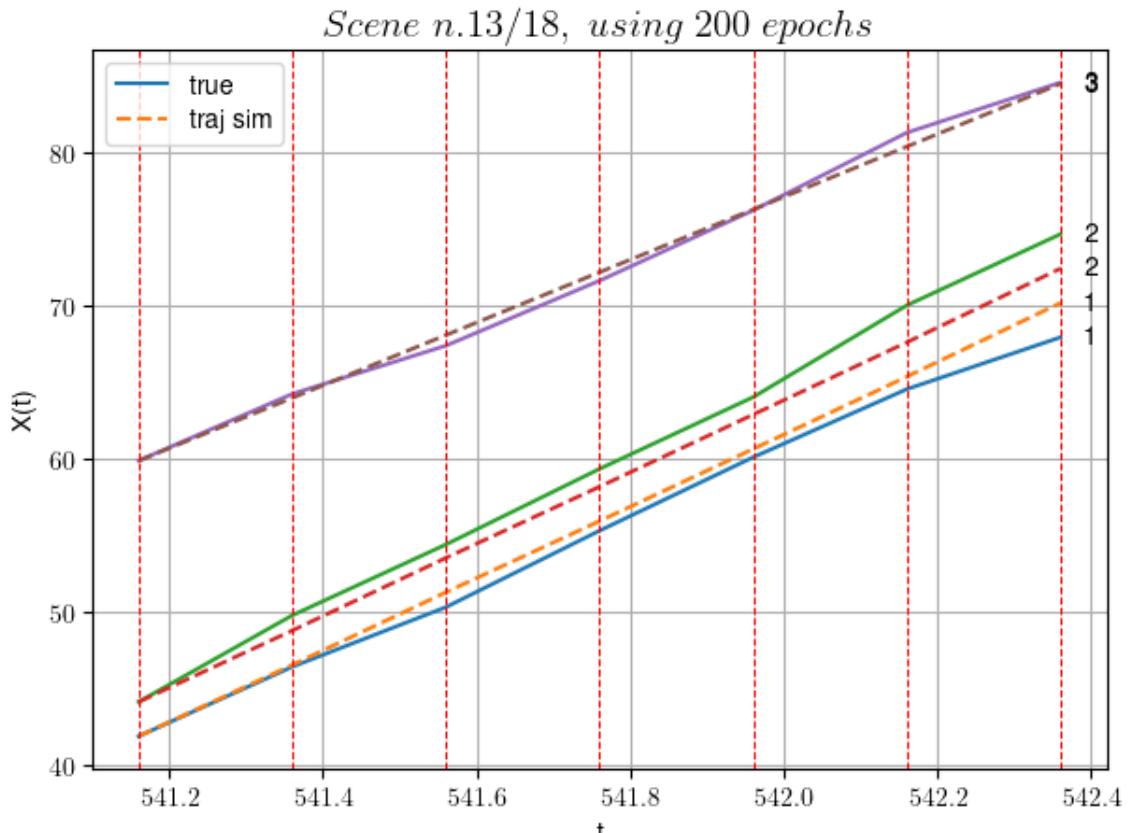
---

---

Scene n.13/18, time interval:[541.16,542.36]

---

---



Loss: 1.1571416020930503  
v0 updated: 20.50043309196578

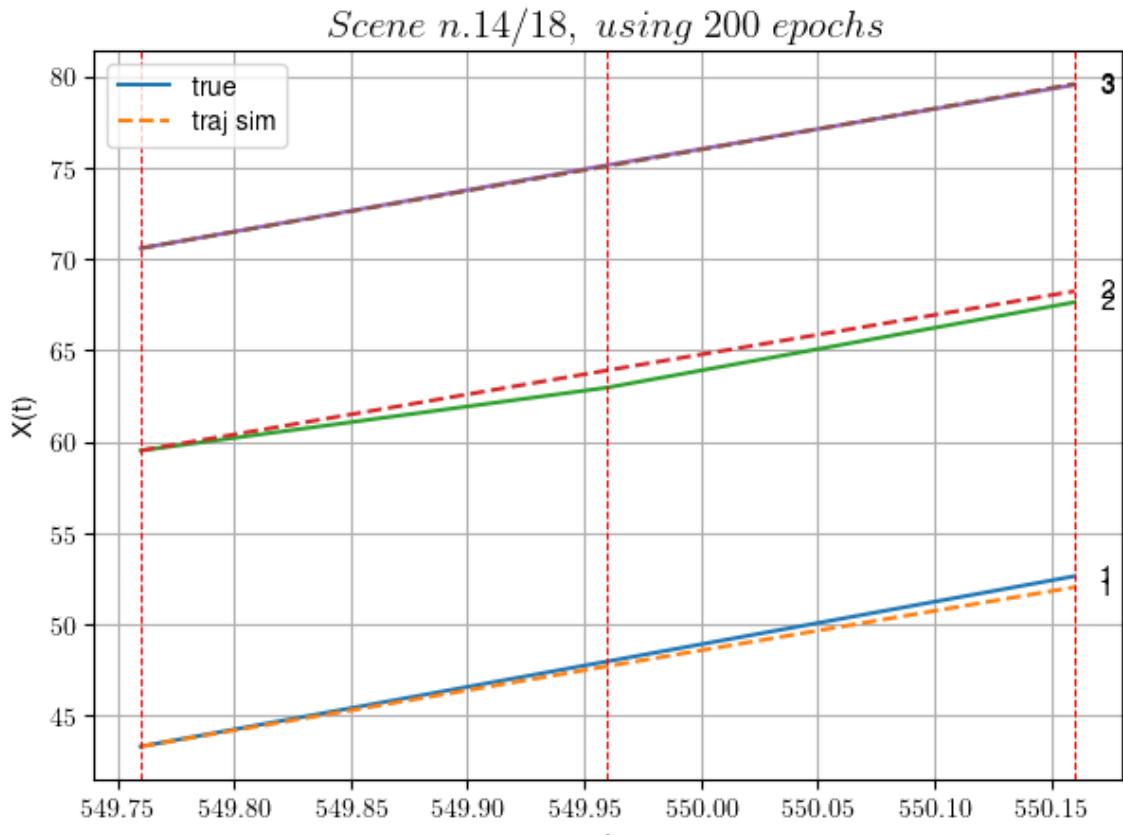
---

---

Scene n.14/18, time interval:[549.76,550.16]

---

---



Loss: 0.1875802248880658  
v0 updated: 22.503959325258233

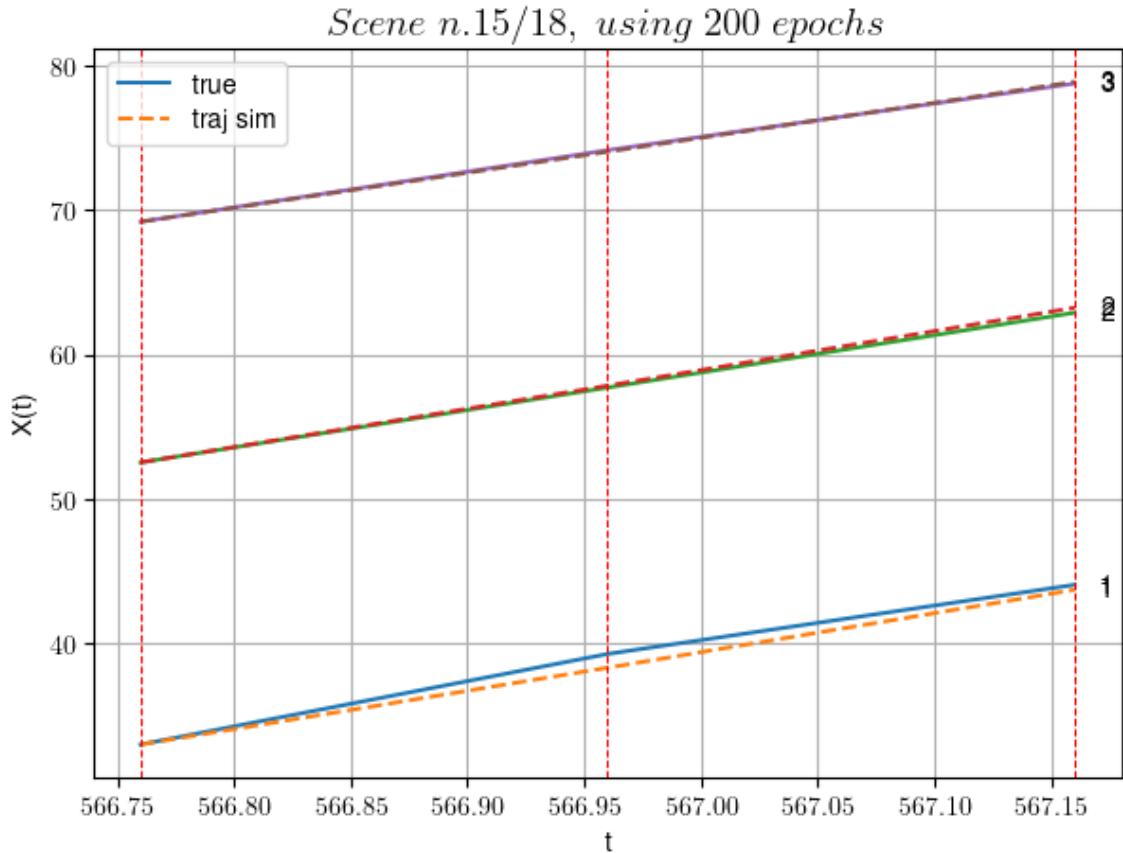
---

---

Scene n.15/18, time interval:[566.76,567.16]

---

---



Loss: 0.13229562802013756  
v0 updated: 24.228864140655777

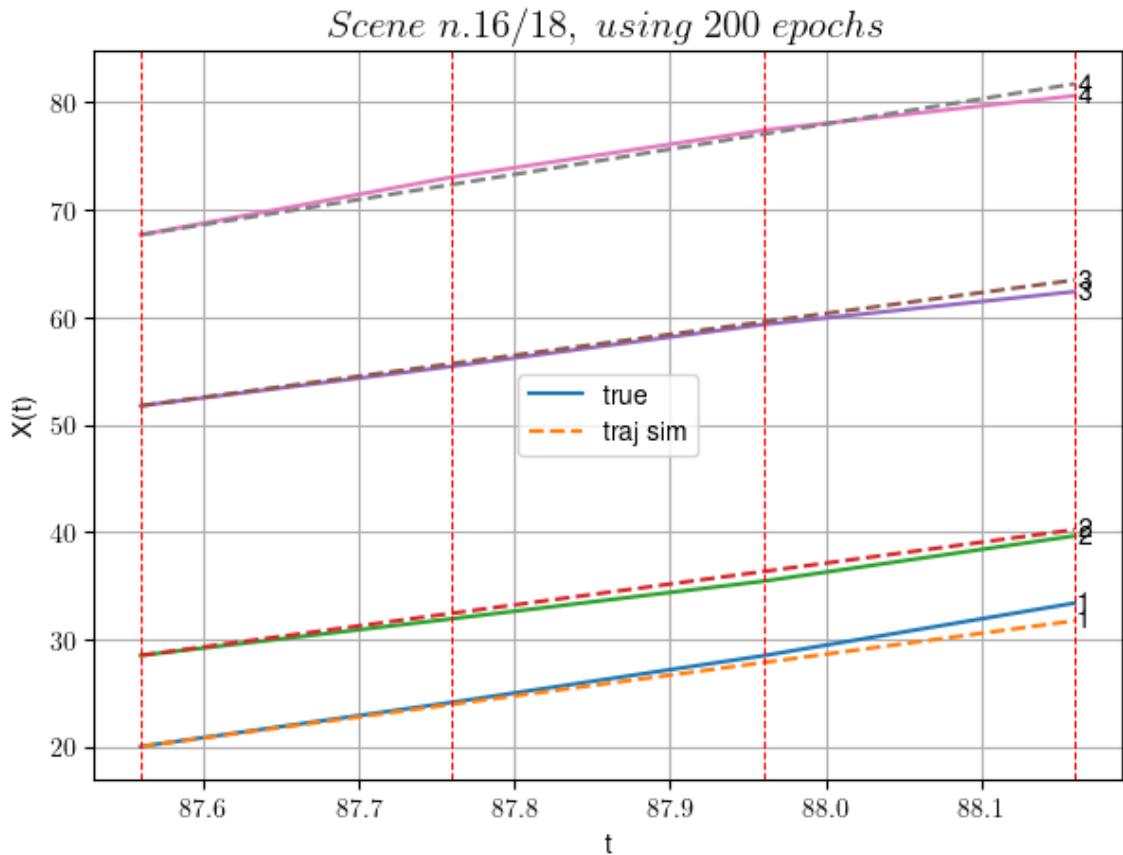
---

---

Scene n.16/18, time interval:[87.56,88.16]

---

---



Loss: 0.4802973314578022  
v0 updated: 23.439775970163954

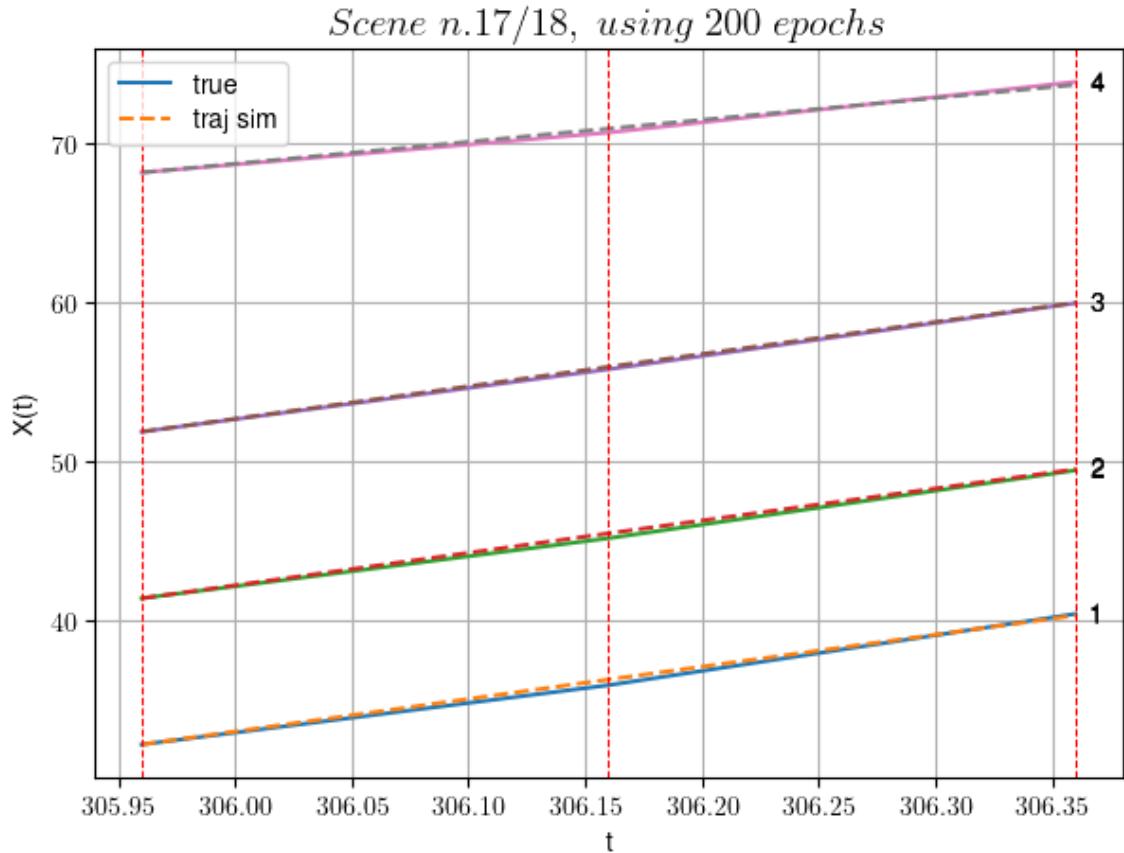
---

---

Scene n.17/18, time interval:[305.96,306.36]

---

---



Loss: 0.0298213442435897  
 $v_0$  updated: 13.781892213856752

---



---

```
v0_mean in this df is: 21.567993269996215
Time taken: 99.88s
Hidden-Layer-1/kernel:0:      [-1.0316630e+01 -7.4186382e+00 -1.
2637139e+05 -6.0159552e+02]
Hidden-Layer-1/bias:0:      [ -9.201245      -6.4950128 -6253.4644
-341.692      ]
Output-Layer/kernel:0:      [-1.7804884e+00  4.9208555e+00 -1.5931100
e+05  1.4249943e+01]
Output-Layer/bias:0:      [20.41999]
```

---



---

In df n.3/10 we have 55 scenes

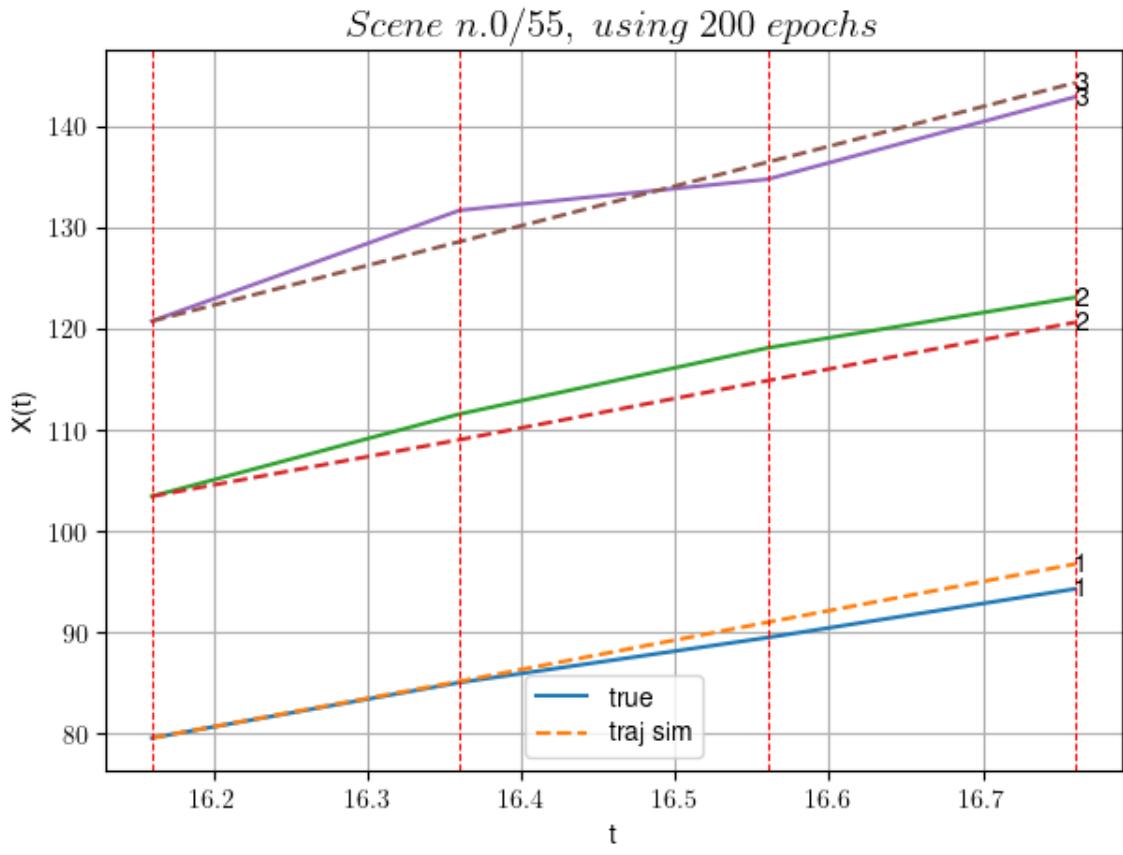
---

Scene n.0/55, time interval:[16.16,16.76]

---



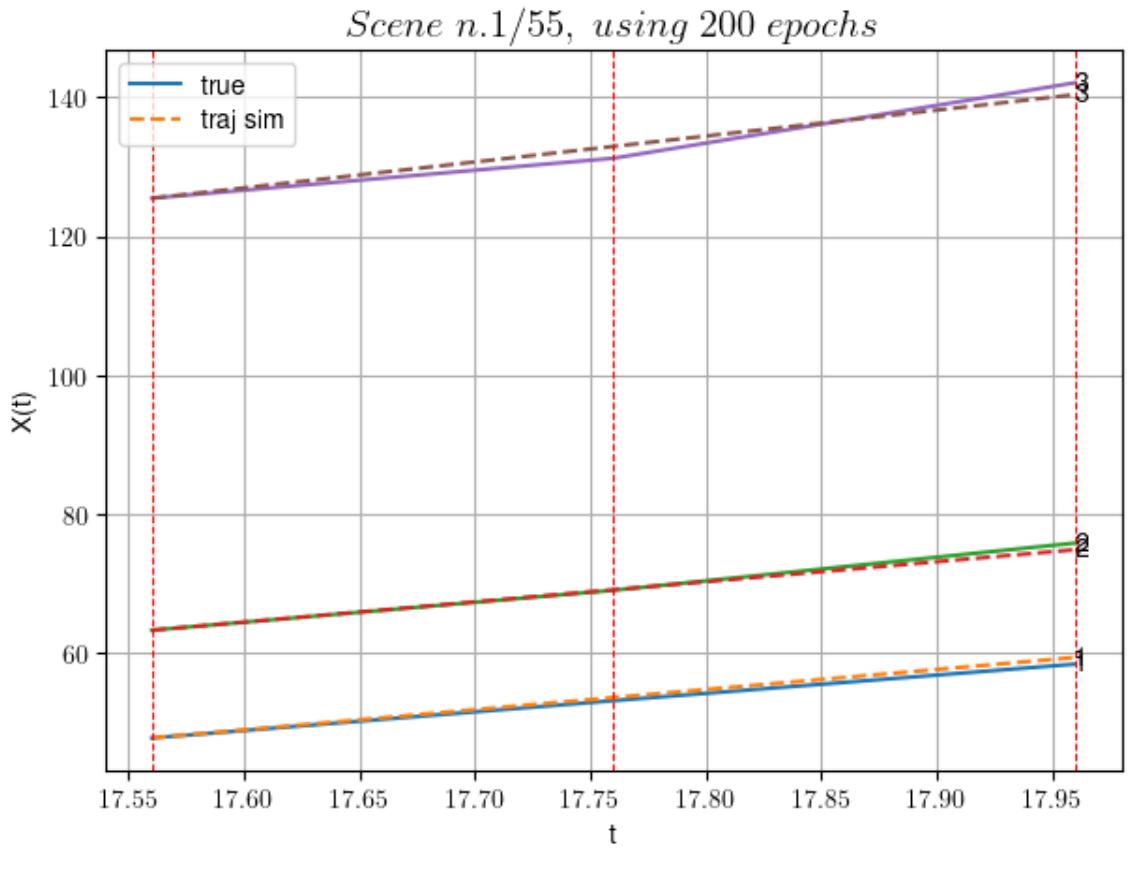
---



---

Scene n.1/55, time interval:[17.56,17.96]

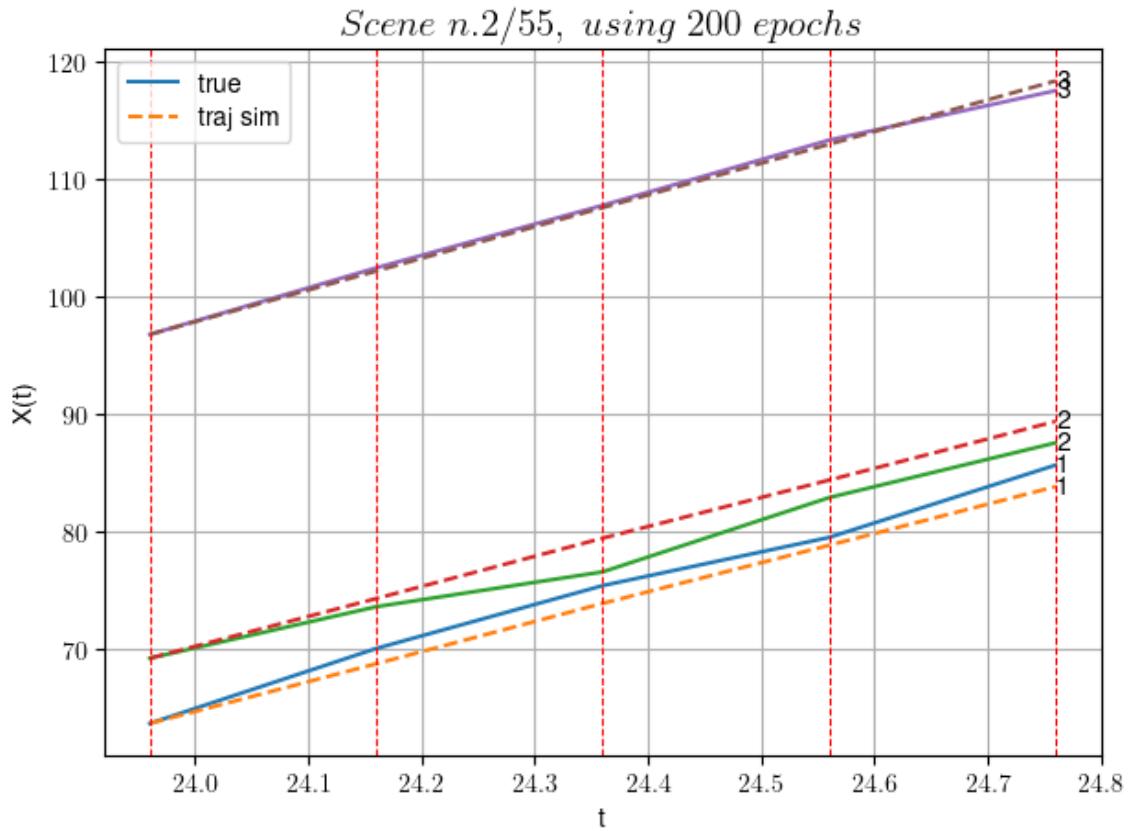
---



---

Scene n.2/55, time interval:[23.96,24.76]

---



Loss: 1.5372377307118974  
v0 updated: 27.01994009594818

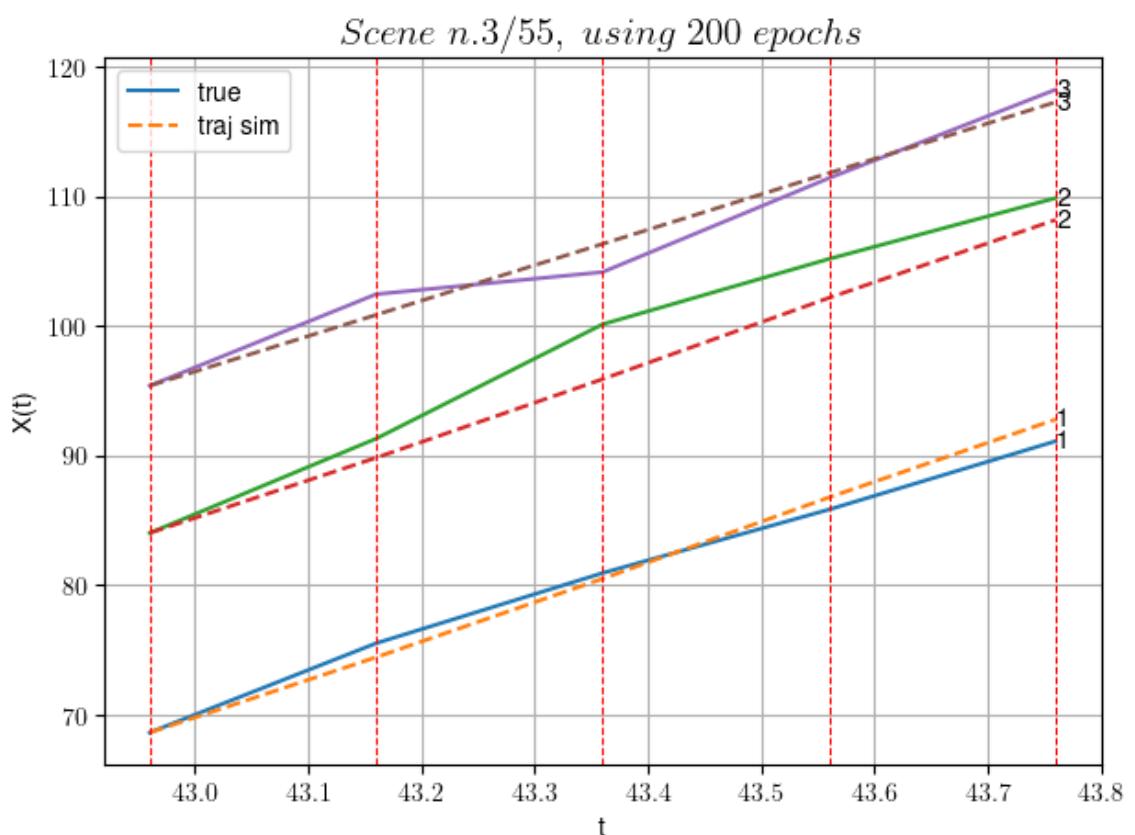
---

---

Scene n.3/55, time interval:[42.96,43.76]

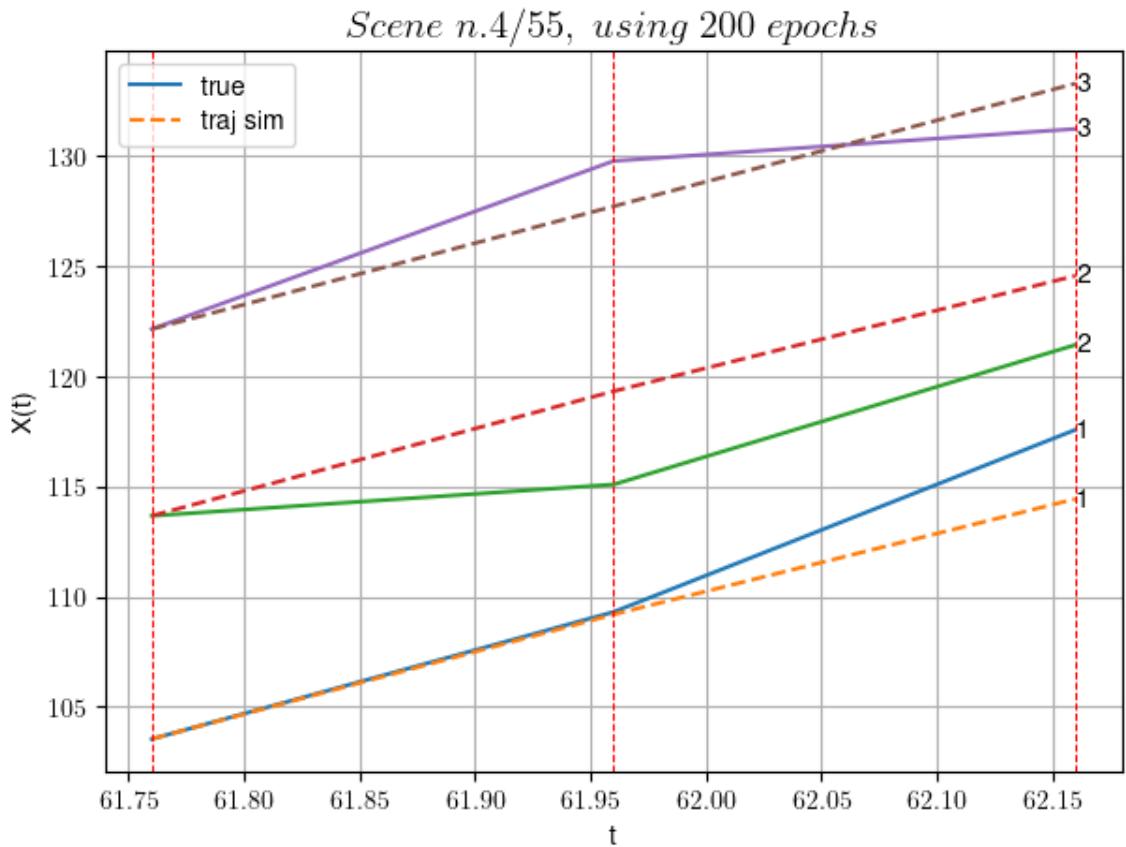
---

---



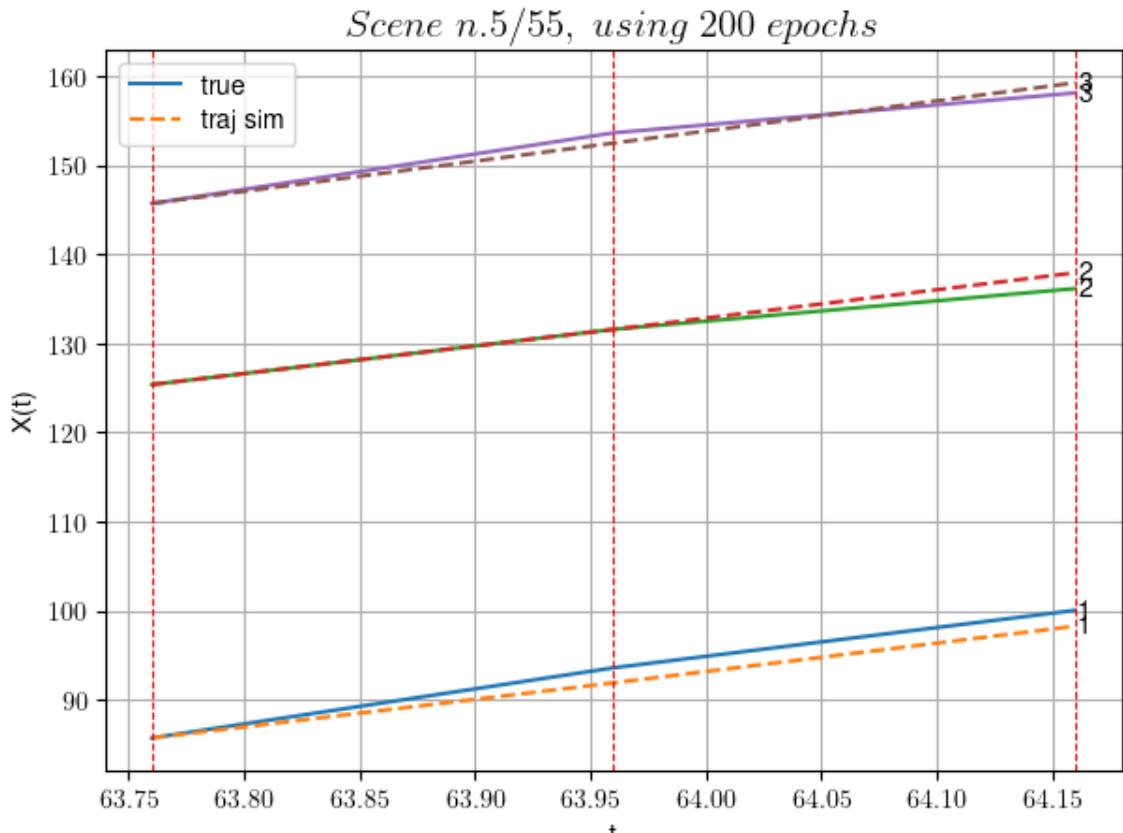
Loss: 3.020812925927542  
v0 updated: 27.353582436749843

Scene n.4/55, time interval:[61.76,62.16]



Loss: 5.1091522333777695  
v0 updated: 27.832473006374567

Scene n.5/55, time interval:[63.76,64.16]



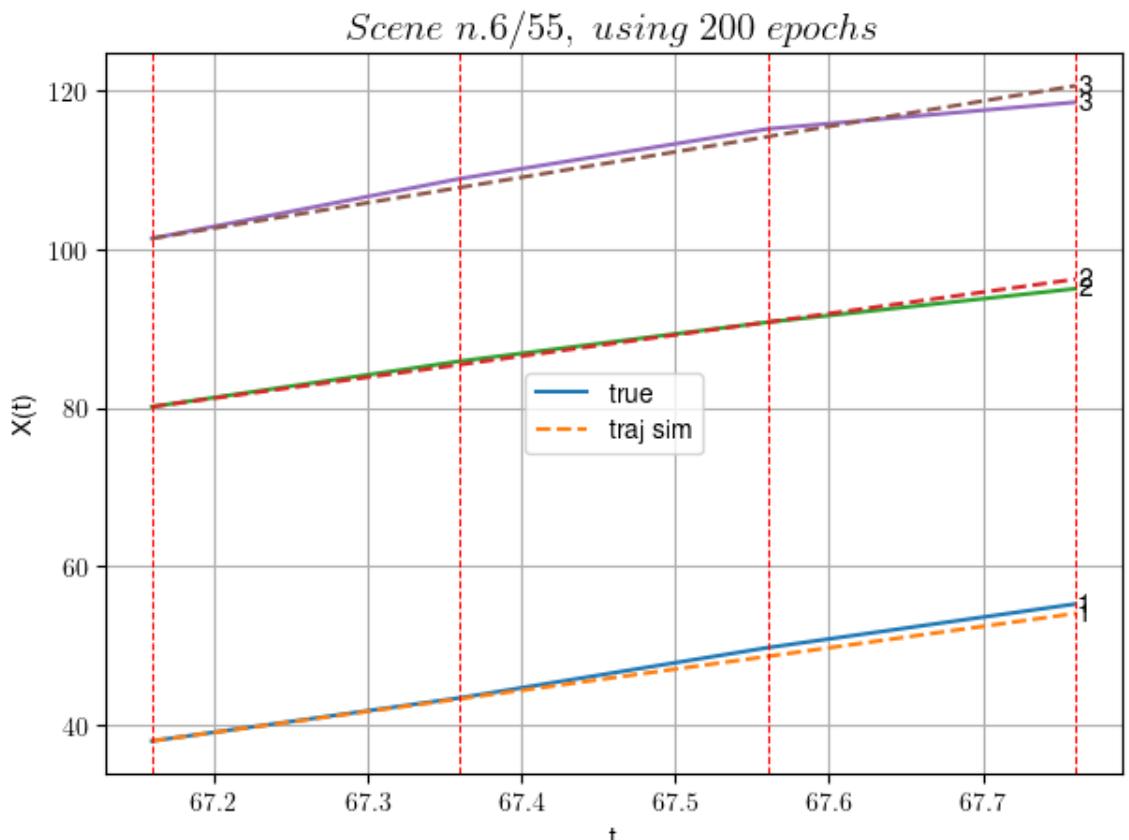
Loss: 1.3038301450132919  
v0 updated: 33.83566643209178

---

---

Scene n.6/55, time interval:[67.16,67.76]

---

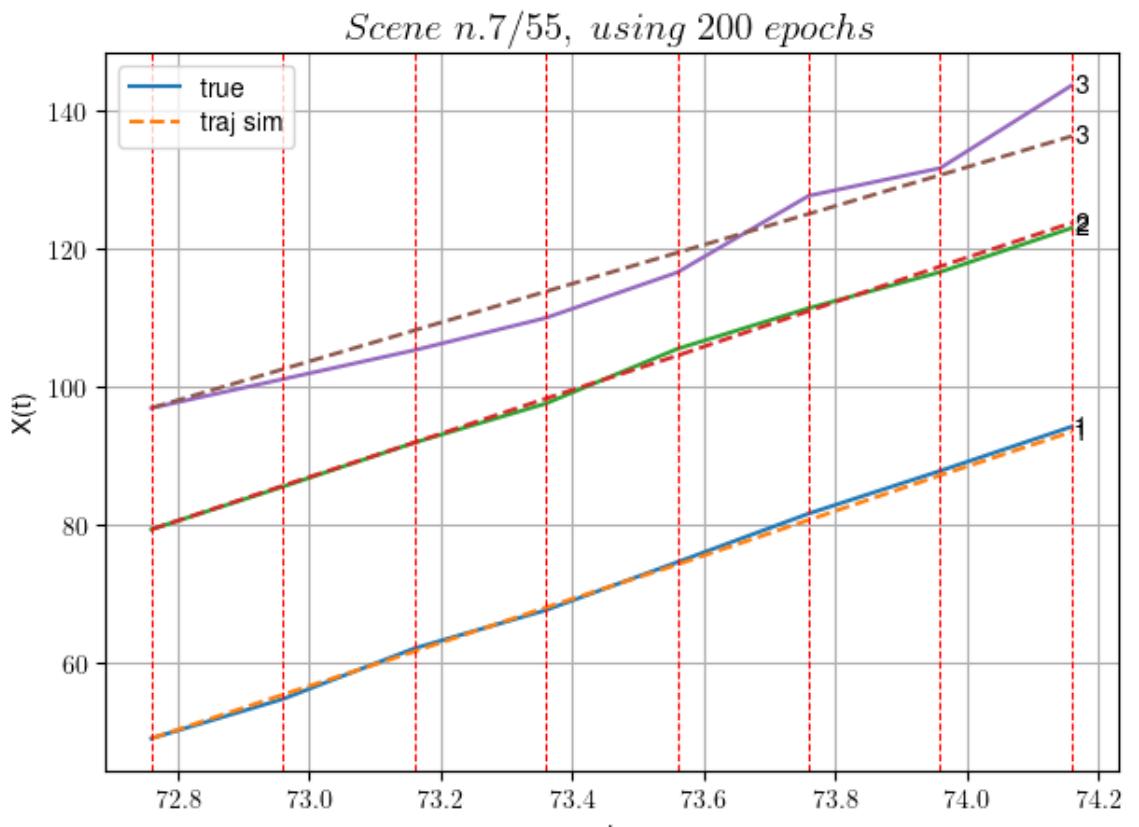


Loss: 0.9009057483640293  
v0 updated: 32.13697253892425

---

Scene n.7/55, time interval:[72.76,74.16]

---



Loss: 4.192558058096769  
v0 updated: 28.12330316633905

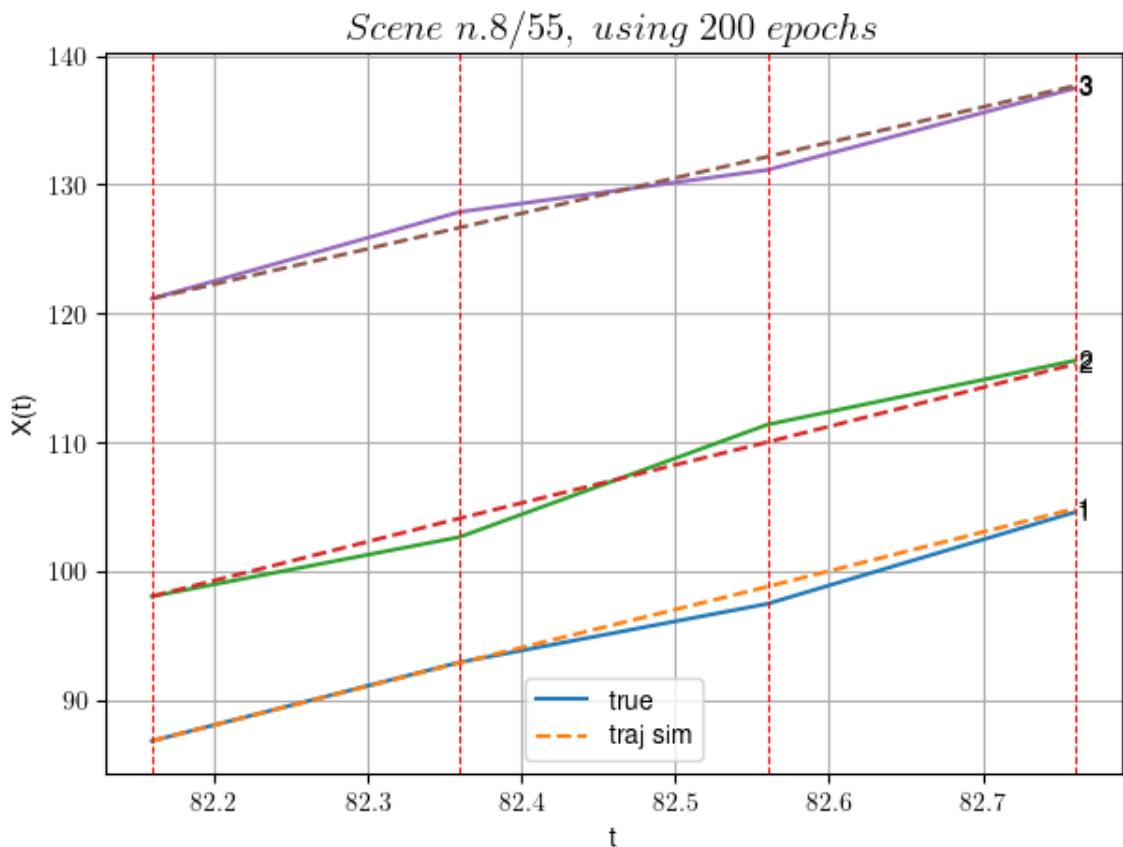
---

---

Scene n.8/55, time interval:[82.16,82.76]

---

---



Loss: 0.7045020146873151  
v0 updated: 27.552927285636404

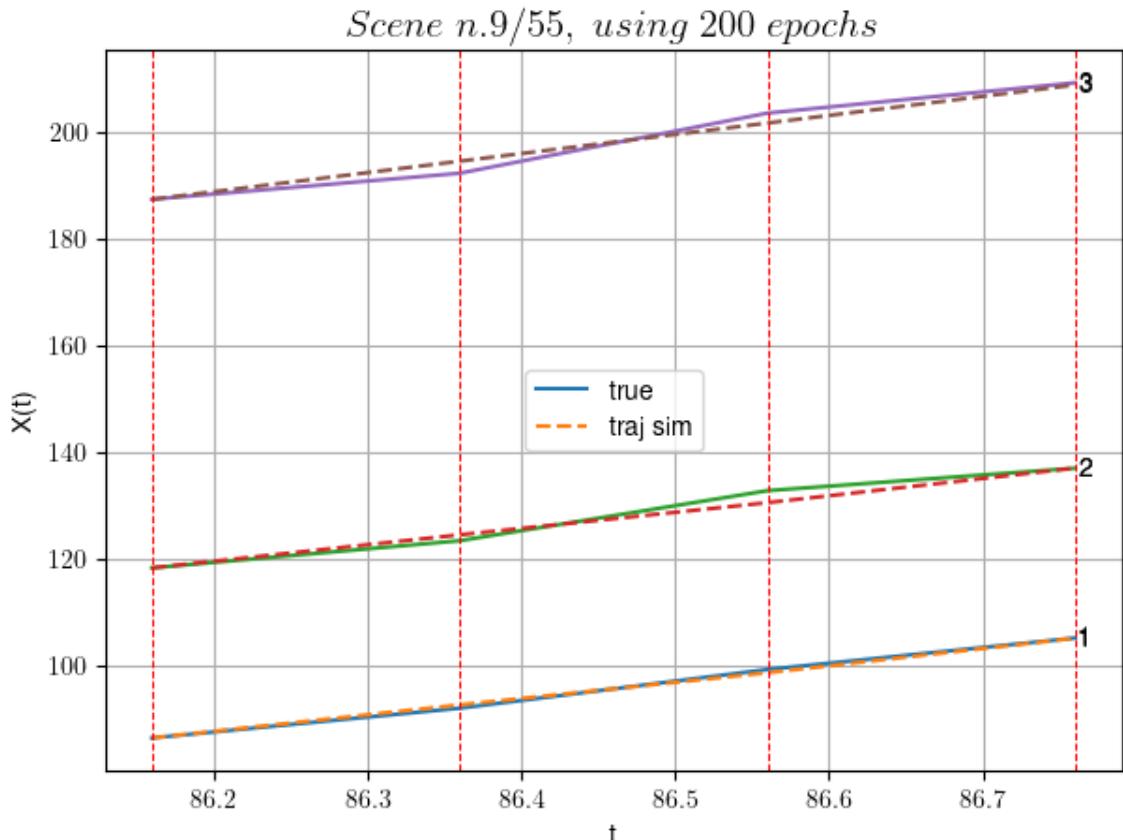
---

---

Scene n.9/55, time interval:[86.16,86.76]

---

---



Loss: 1.3144505416562786  
v0 updated: 35.758406855917755

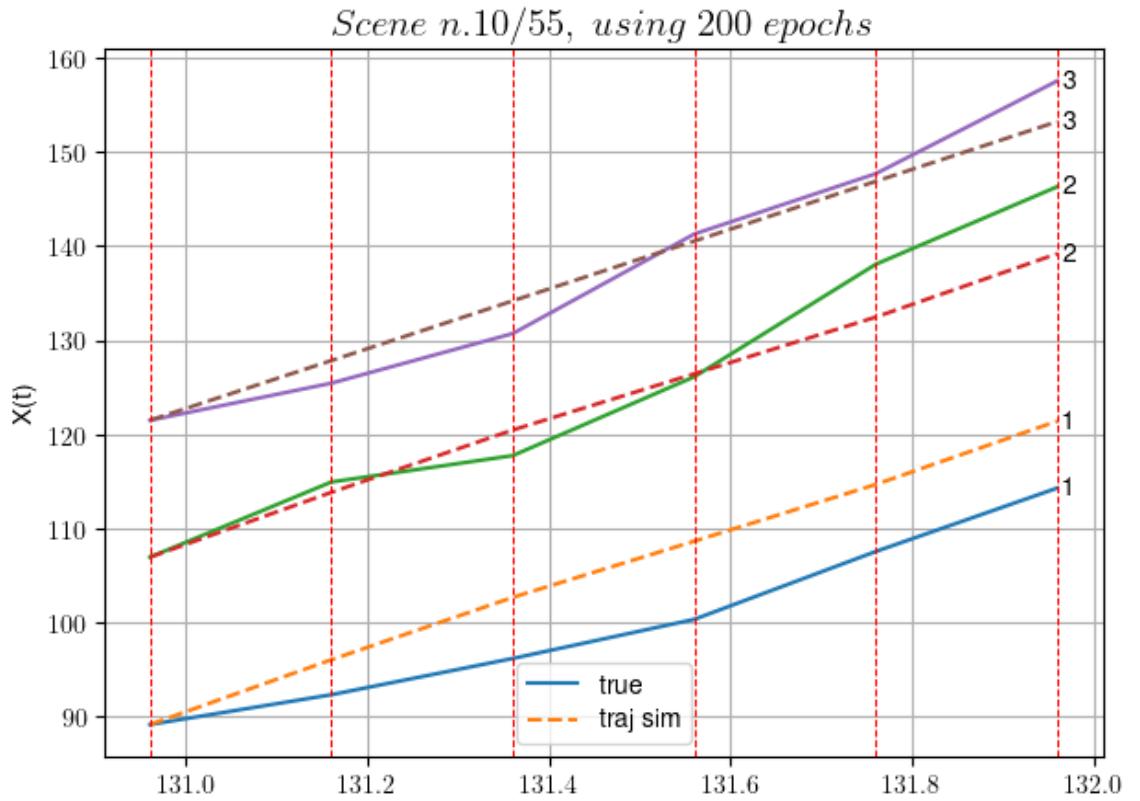
---

---

Scene n.10/55, time interval:[130.96,131.96]

---

---



Loss: 19.730305379289813  
v0 updated: 31.750413794800306

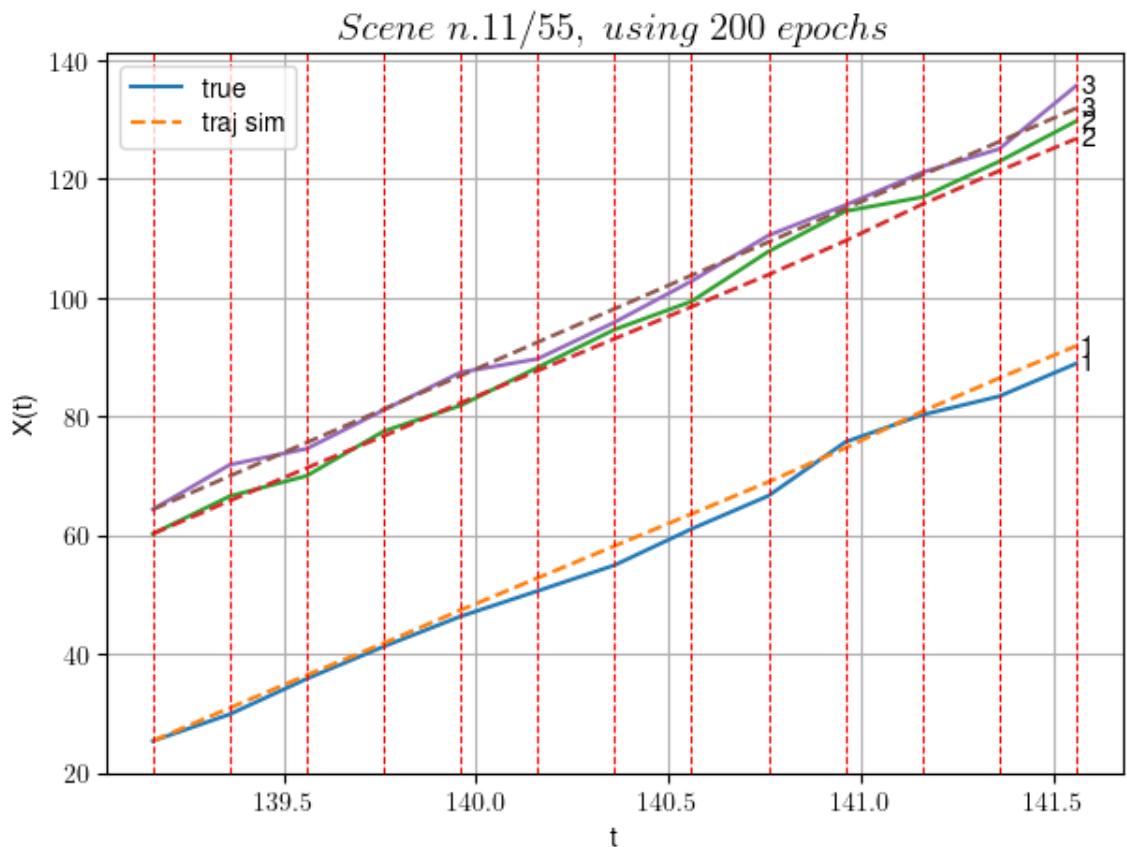
---

---

Scene n.11/55, time interval:[139.16,141.56]

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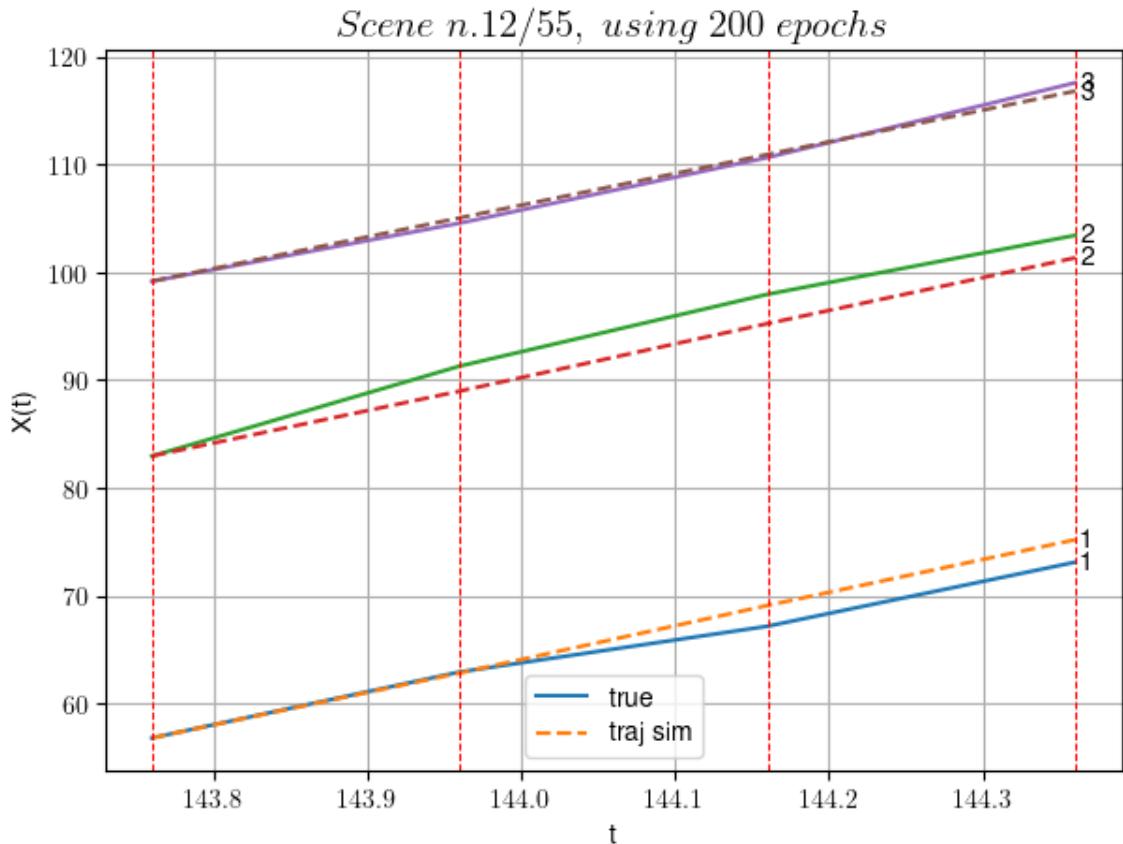


Loss: 3.735227024669187  
v0 updated: 28.146667787591962

---

Scene n.12/55, time interval:[143.76,144.36]

---



Loss: 2.174639747026396  
v0 updated: 29.41538708161572

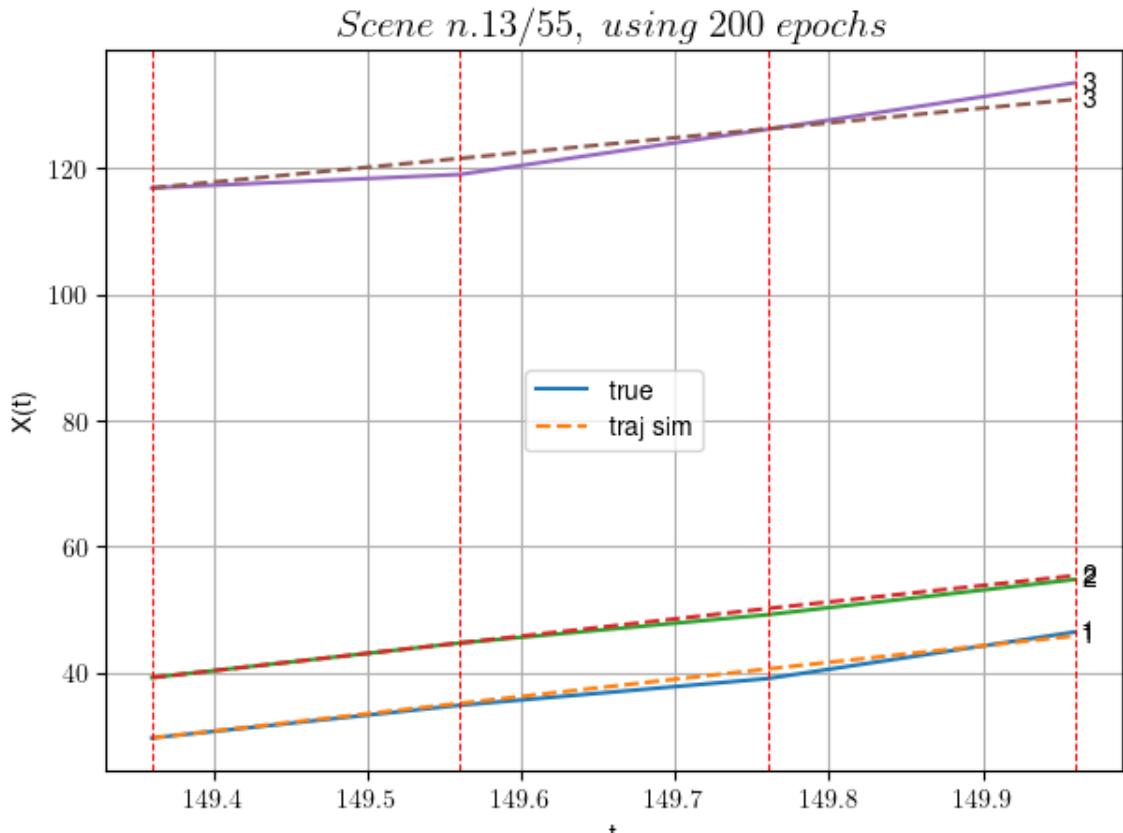
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Scene n.13/55, time interval:[149.36,149.96]

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Loss: 1.4649157223513163  
v0 updated: 23.450754392043912

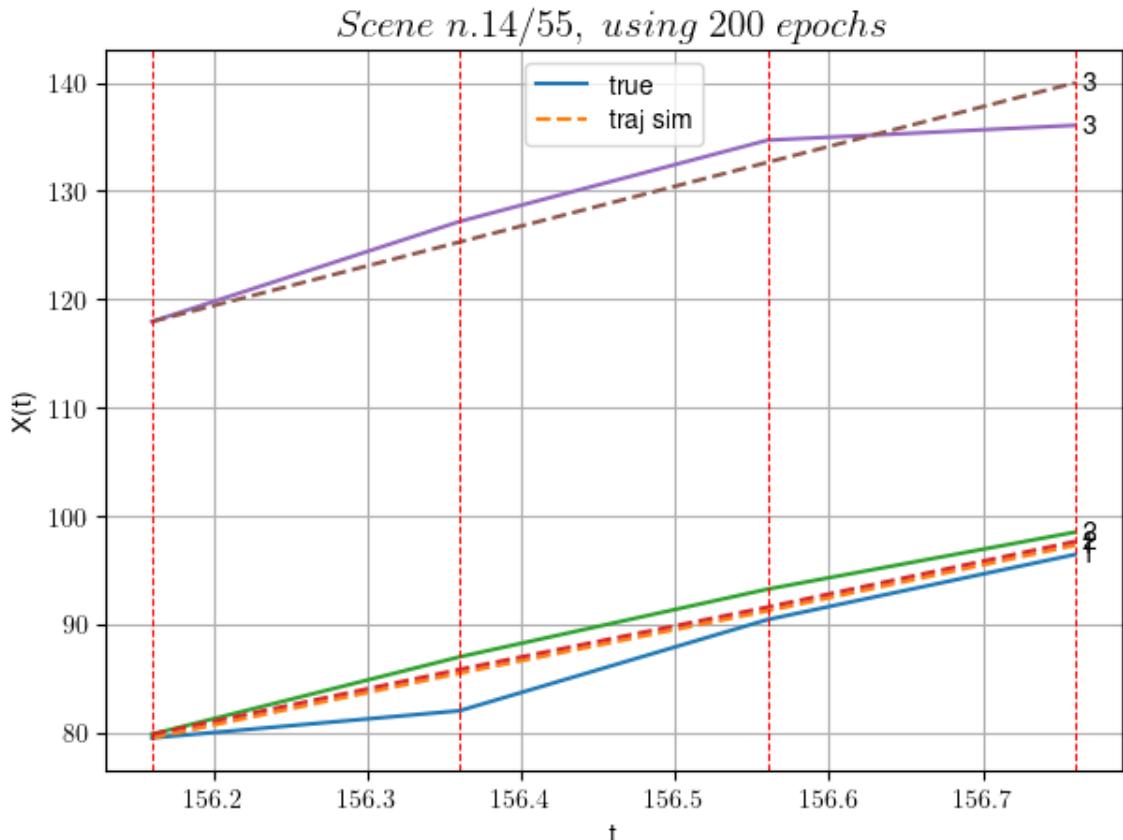
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Scene n.14/55, time interval:[156.16,156.76]

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Loss: 3.459846196923484  
v0 updated: 36.77217279713534

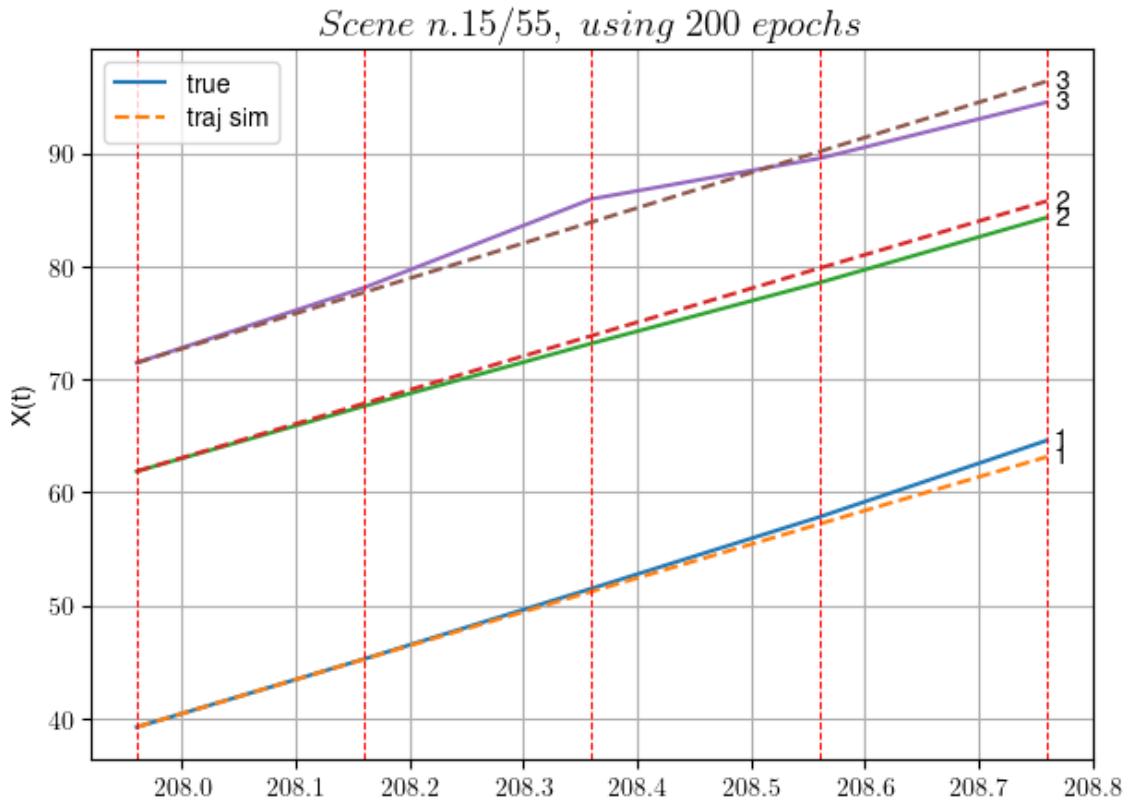
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Scene n.15/55, time interval:[207.96,208.76]

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---



Loss: 0.9968770072551134  
v0 updated: 31.123674479426654

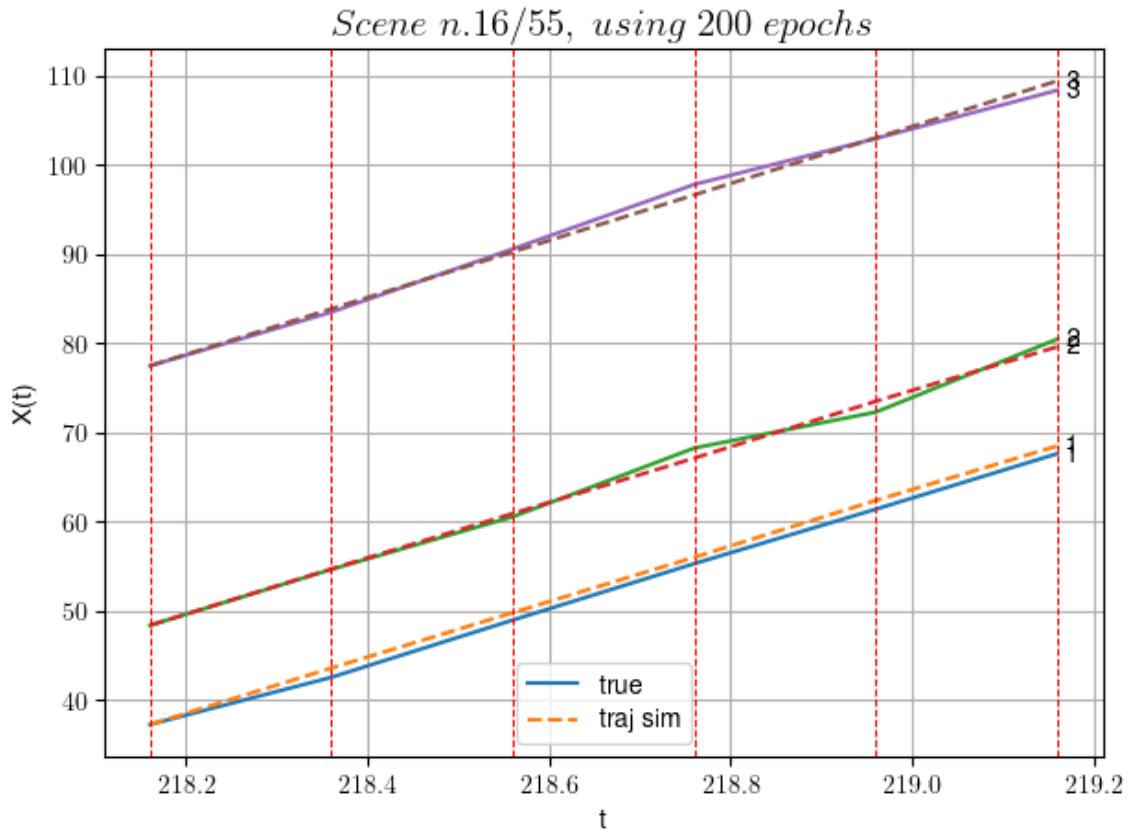
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Scene n.16/55, time interval:[218.16,219.16]

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Loss: 0.5731601246156511  
v0 updated: 31.94478783305763

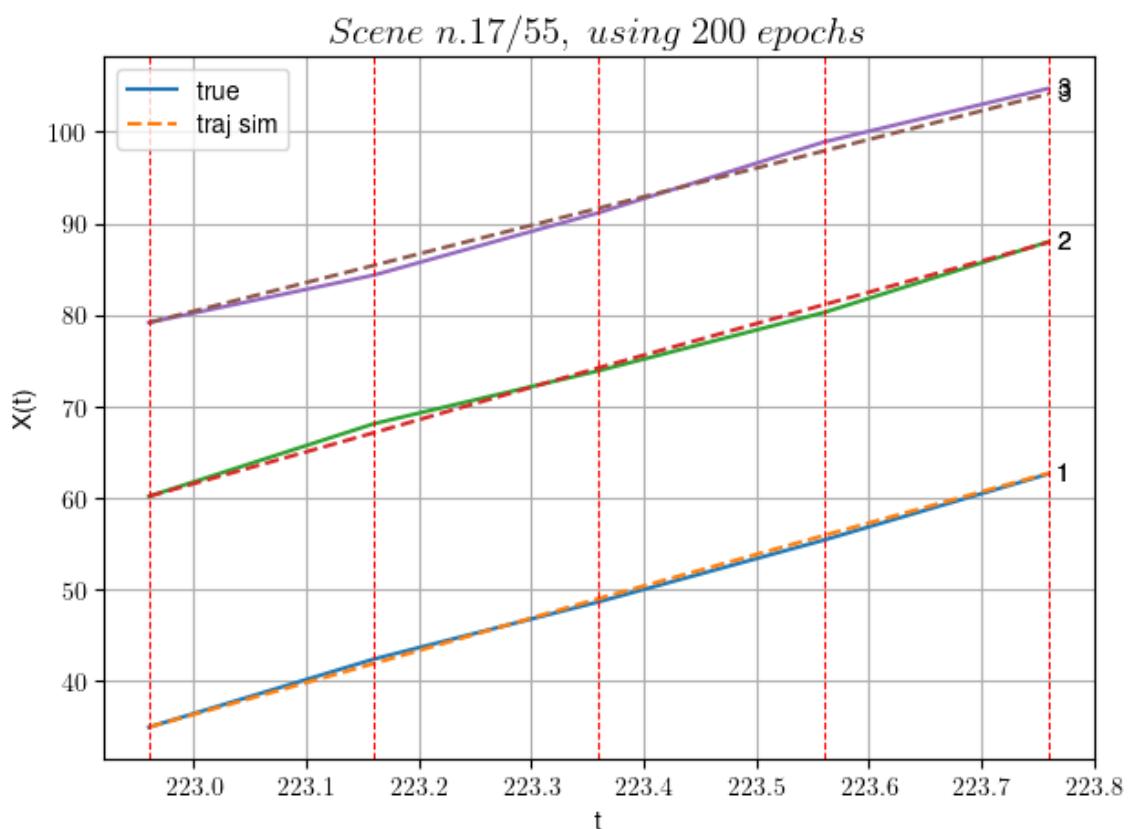
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Scene n.17/55, time interval:[222.96,223.76]

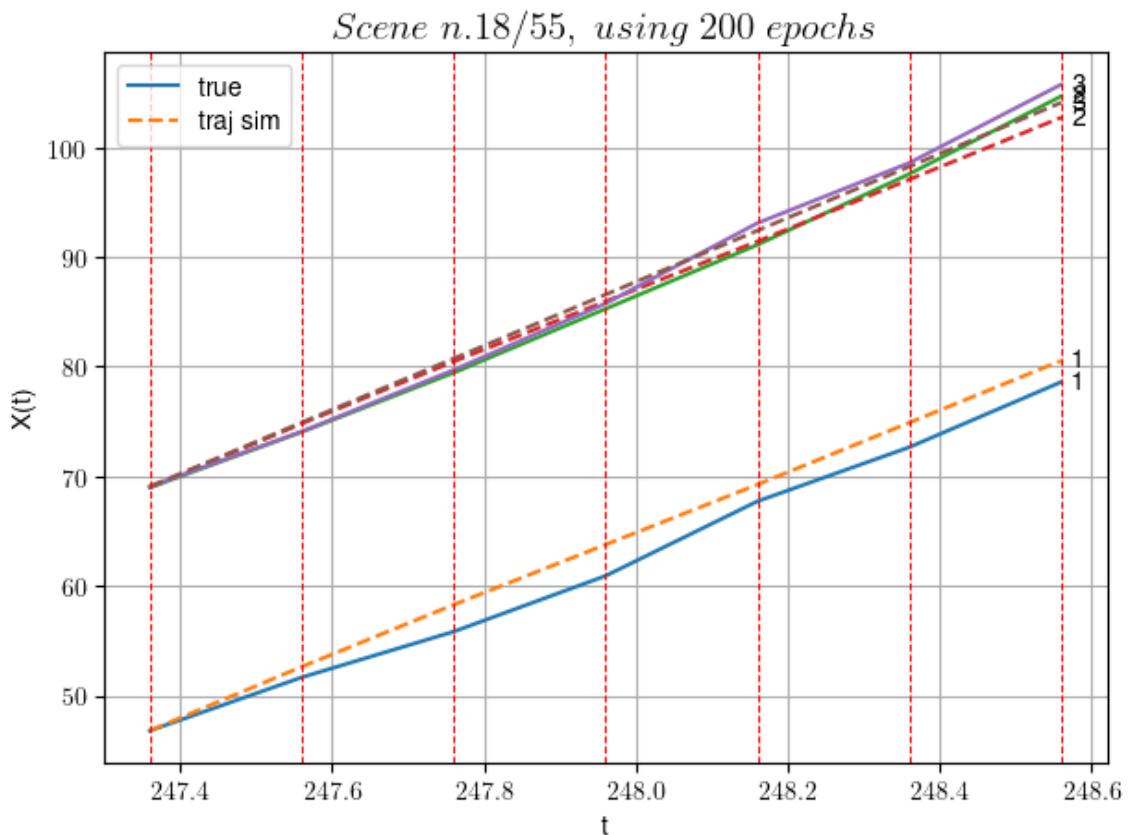
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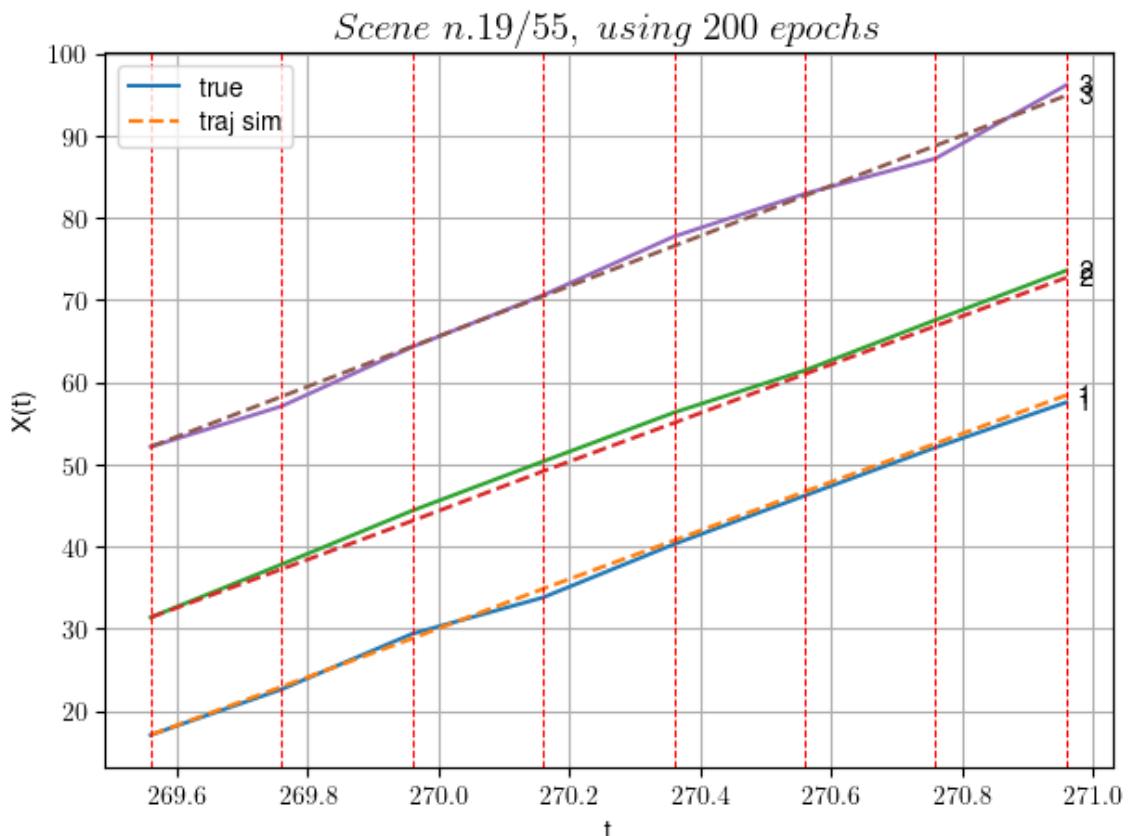
Loss: 0.34102353018517834  
v0 updated: 31.27834550412877

Scene n.18/55, time interval:[247.36,248.56]



Loss: 1.8195684333635036  
v0 updated: 29.200424002930866

Scene n.19/55, time interval:[269.56,270.96]



Loss: 0.6733795875888634  
v0 updated: 30.538583647650018

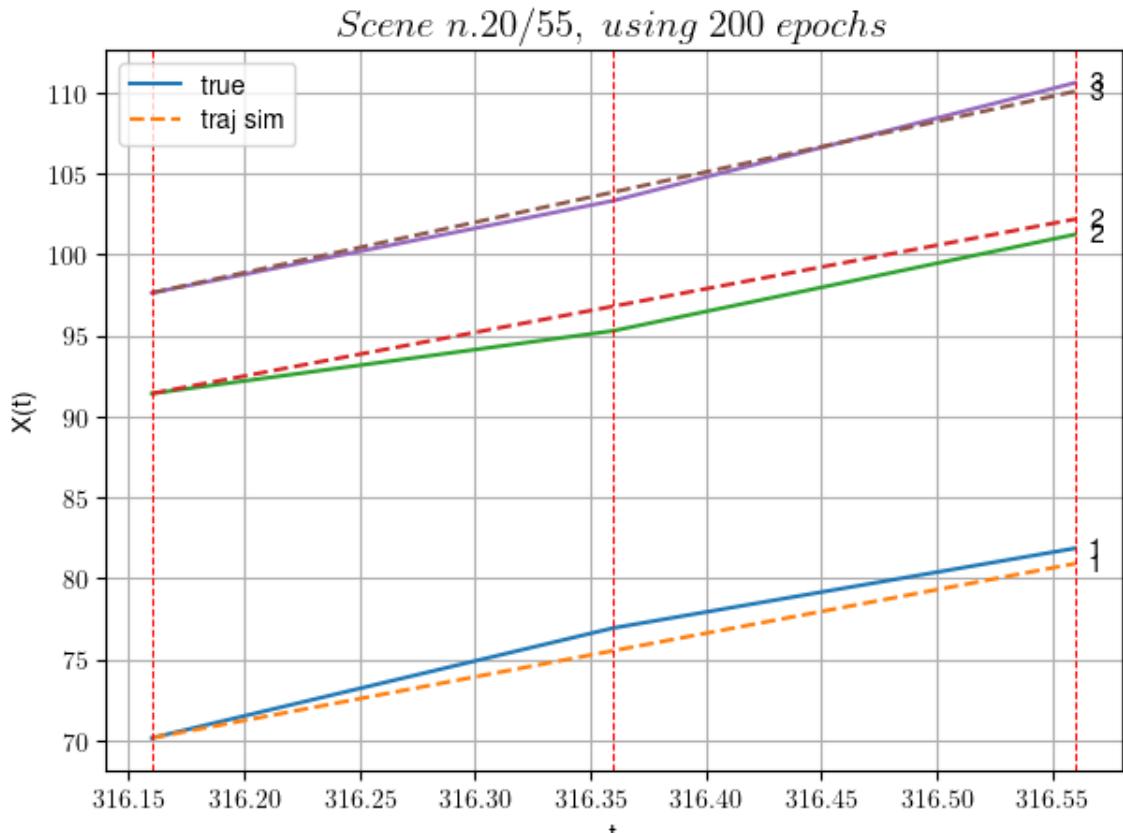
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Scene n.20/55, time interval:[316.16,316.56]

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Loss: 0.7338952924830976  
v0 updated: 31.118501827373837

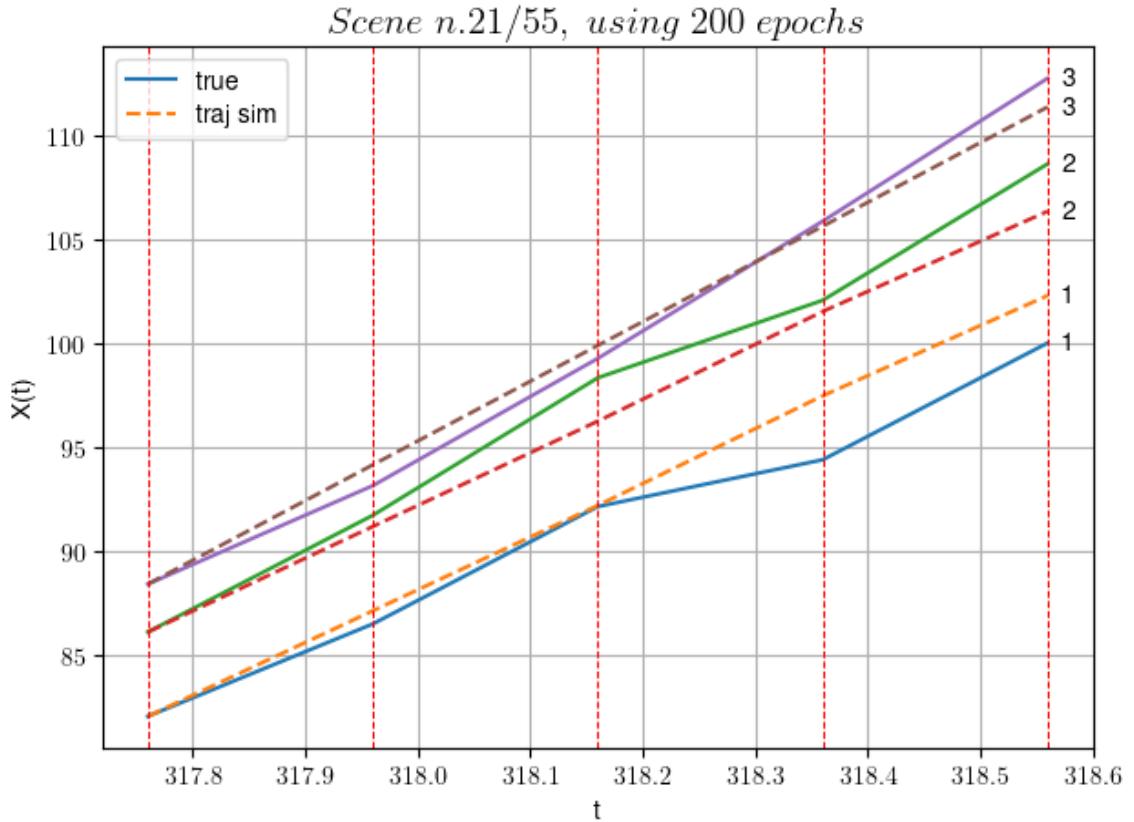
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Scene n.21/55, time interval:[317.76,318.56]

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Loss: 1.9089883956920042  
 $v_0$  updated: 28.731001411505467

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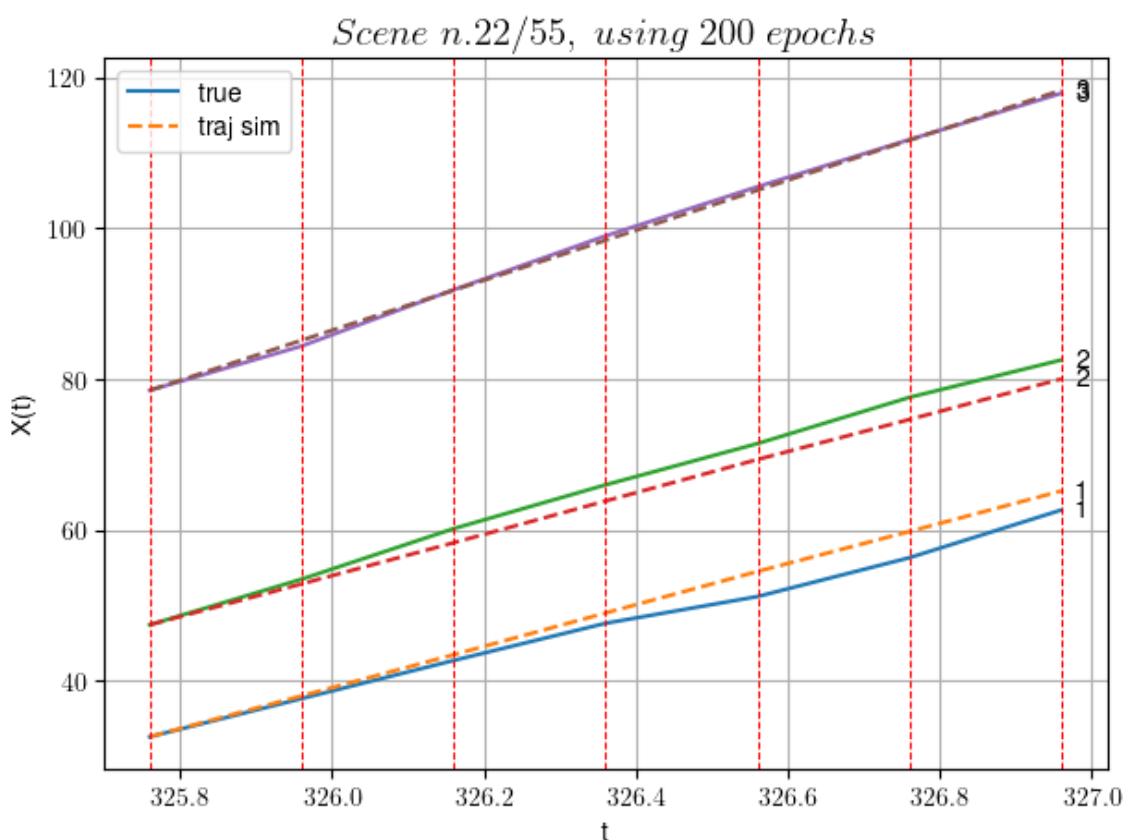
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Scene n.22/55, time interval:[325.76,326.96]

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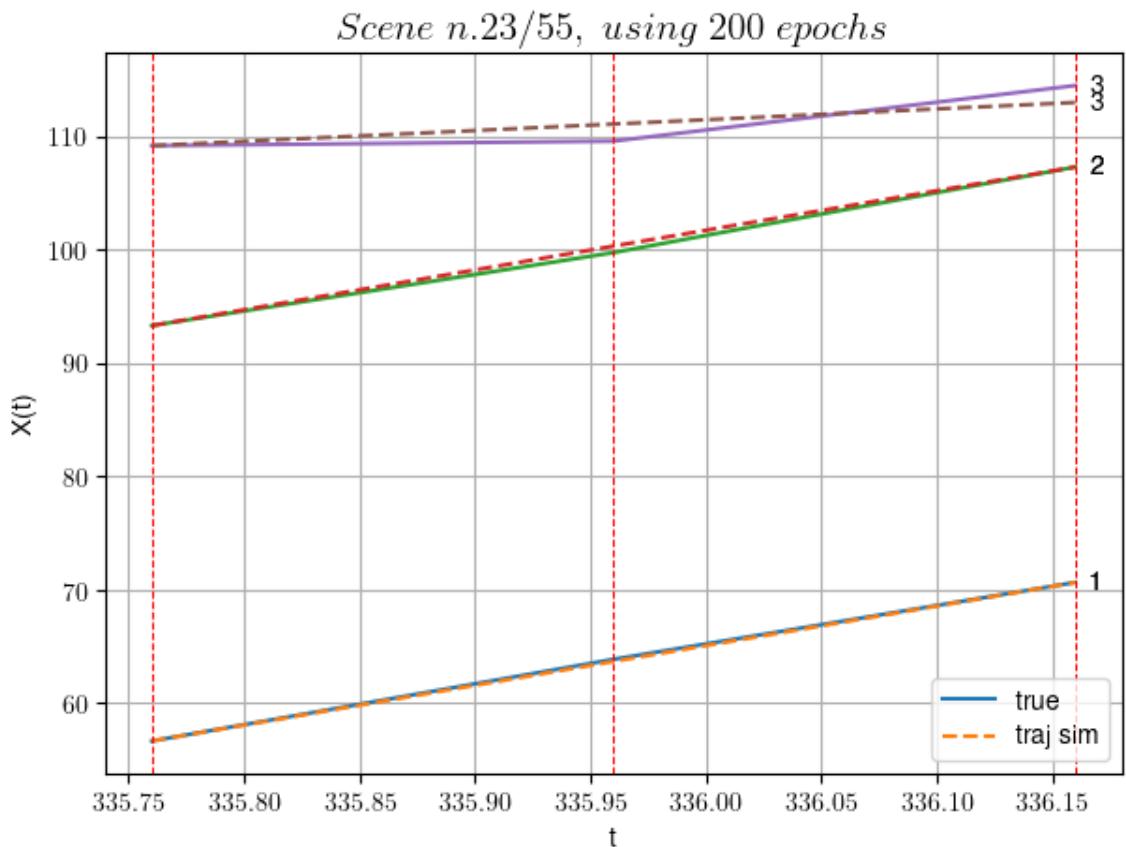


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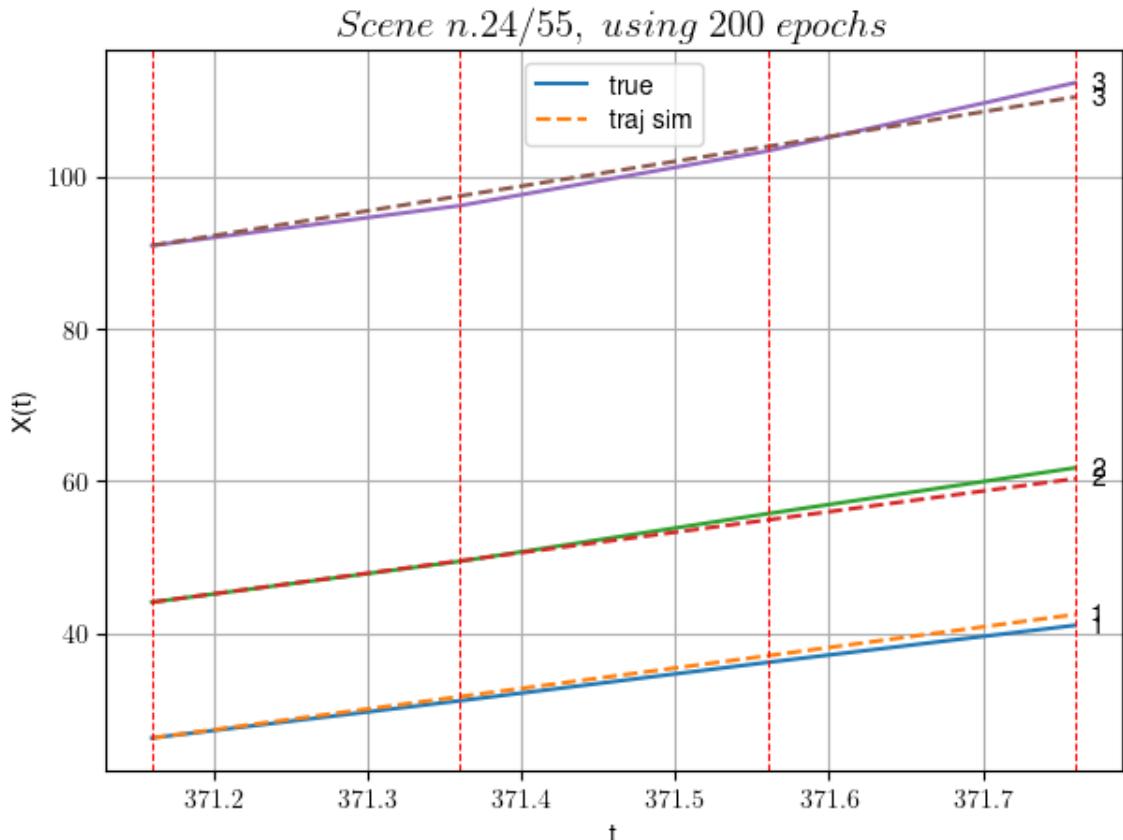
Loss: 2.9129313295933734  
v0 updated: 33.13210942893414

Scene n.23/55, time interval:[335.76,336.16]



Loss: 0.5398193119908694  
v0 updated: 9.51819454011644

Scene n.24/55, time interval:[371.16,371.76]



Loss: 0.93868427497265  
v0 updated: 32.53671918608213

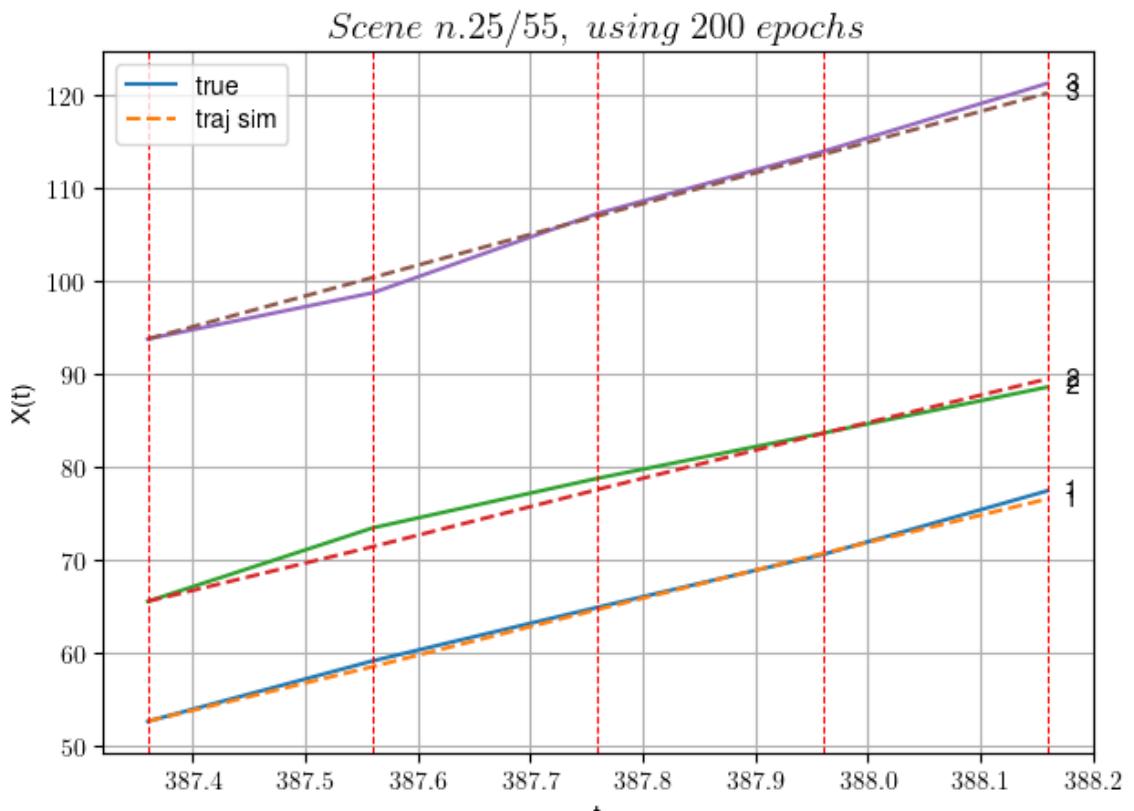
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Scene n.25/55, time interval:[387.36,388.16]

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Loss: 0.7667661385413199  
v0 updated: 33.02856902380123

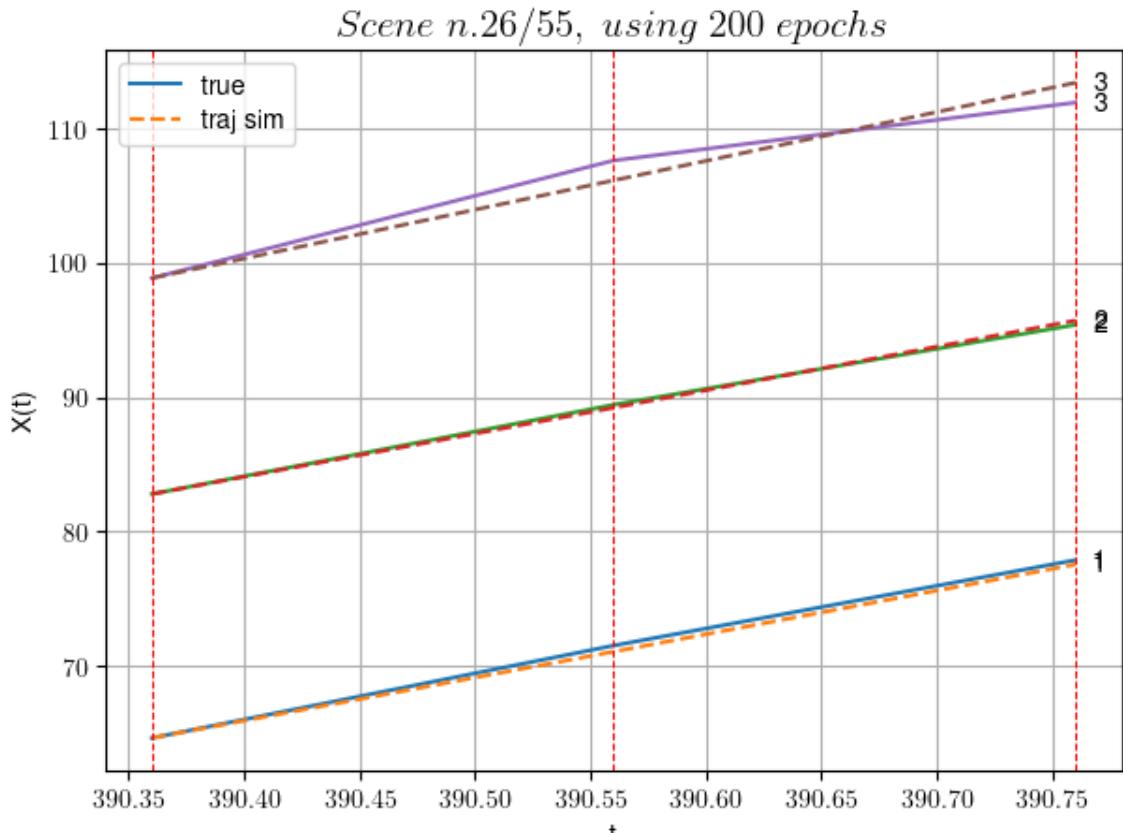
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Scene n.26/55, time interval:[390.36,390.76]

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Loss: 0.5367480781255706  
v0 updated: 36.3472833737466

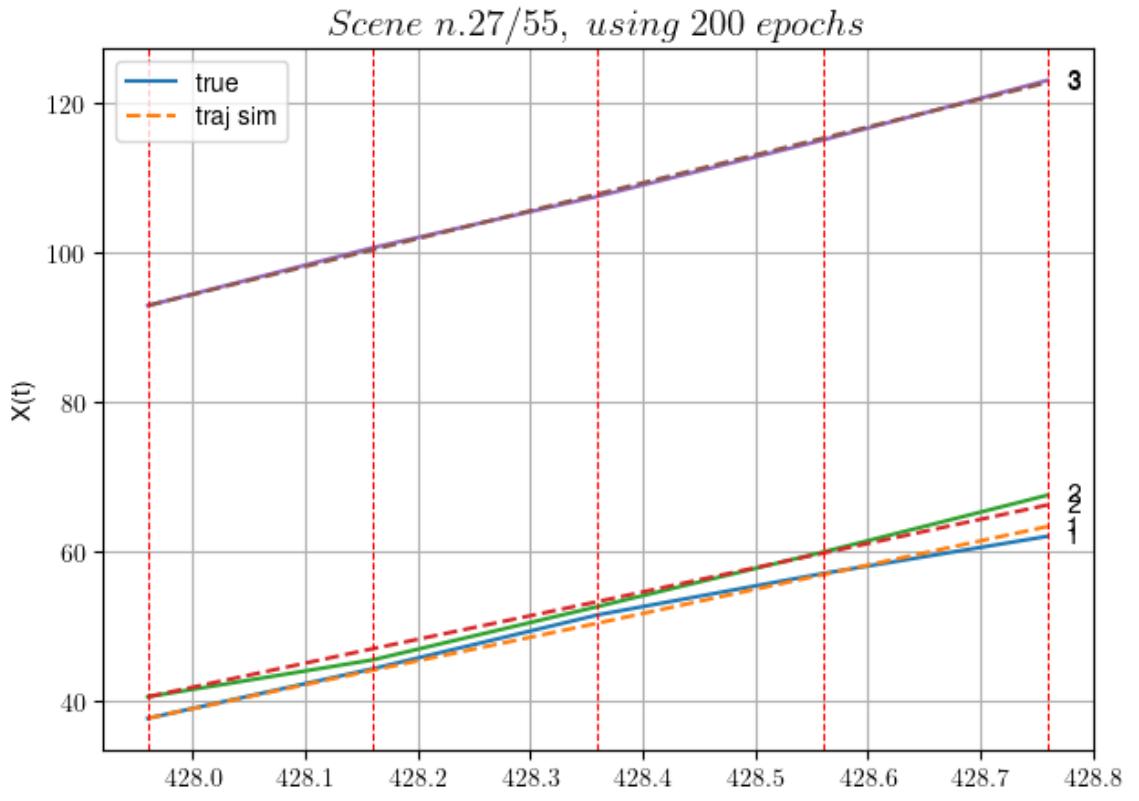
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Scene n.27/55, time interval:[427.96,428.76]

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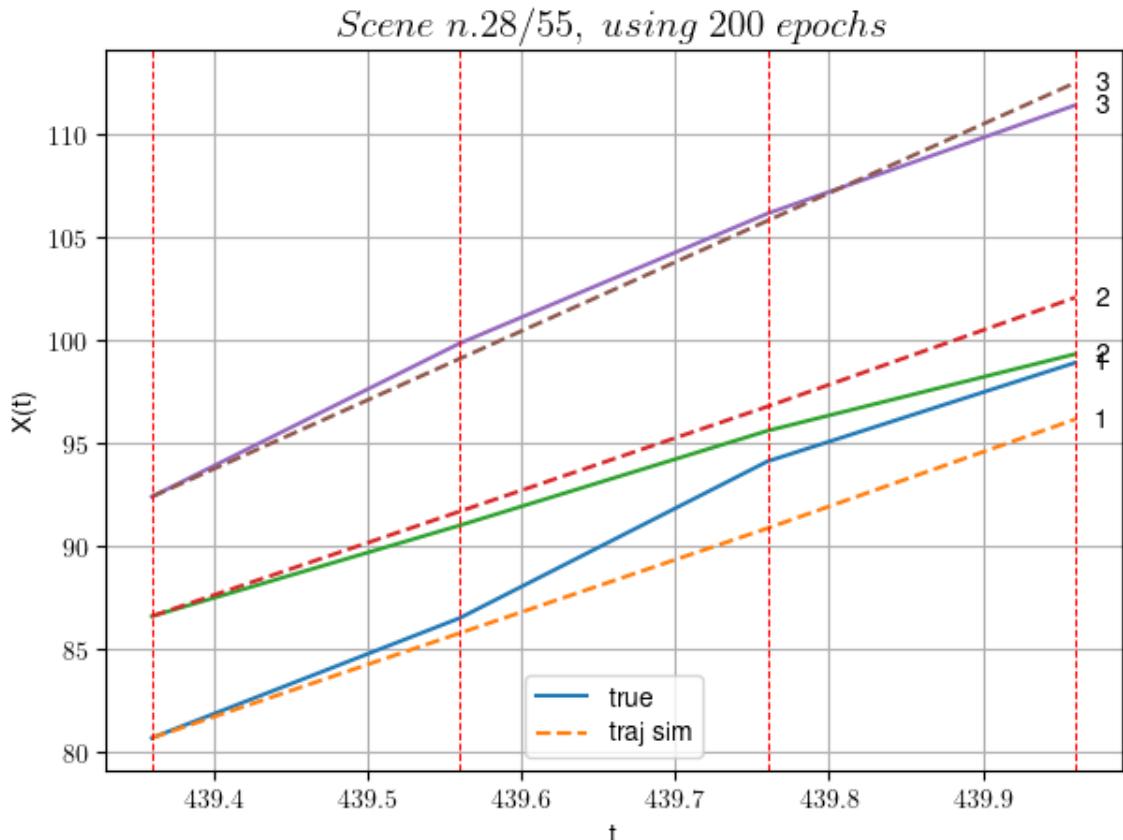
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Scene n.28/55, time interval:[439.36,439.96]

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Loss: 2.492687316067164  
v0 updated: 33.53249558198438

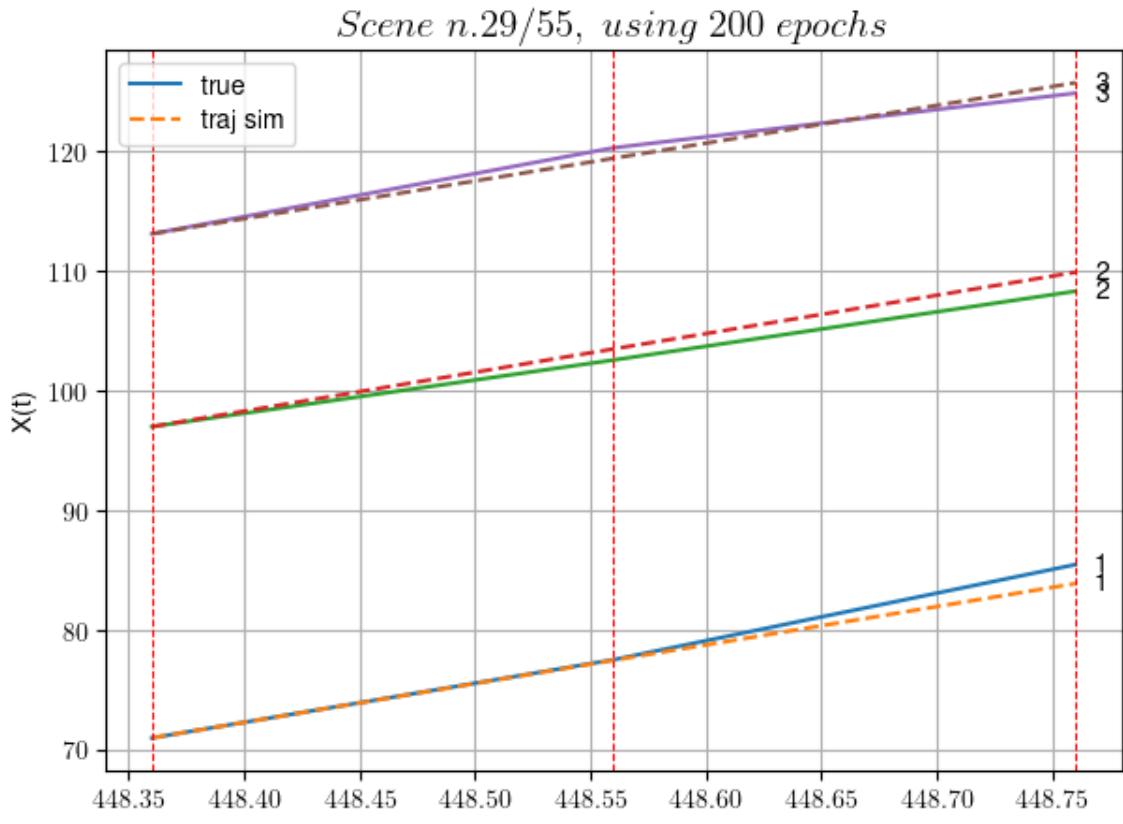
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Scene n.29/55, time interval:[448.36,448.76]

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Loss: 0.8245165678146941  
v0 updated: 31.583307782368443

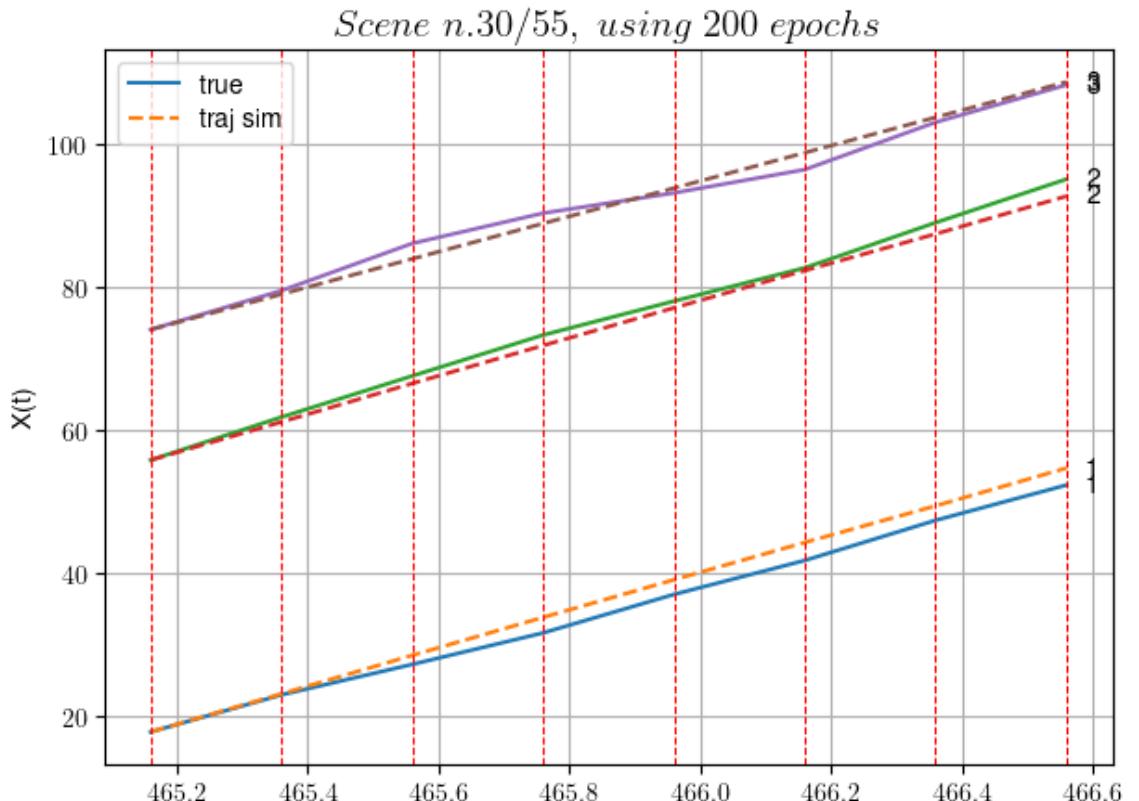
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Scene n.30/55, time interval:[465.16,466.56]

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Loss: 2.213056104503791  
v0 updated: 24.727874292569464

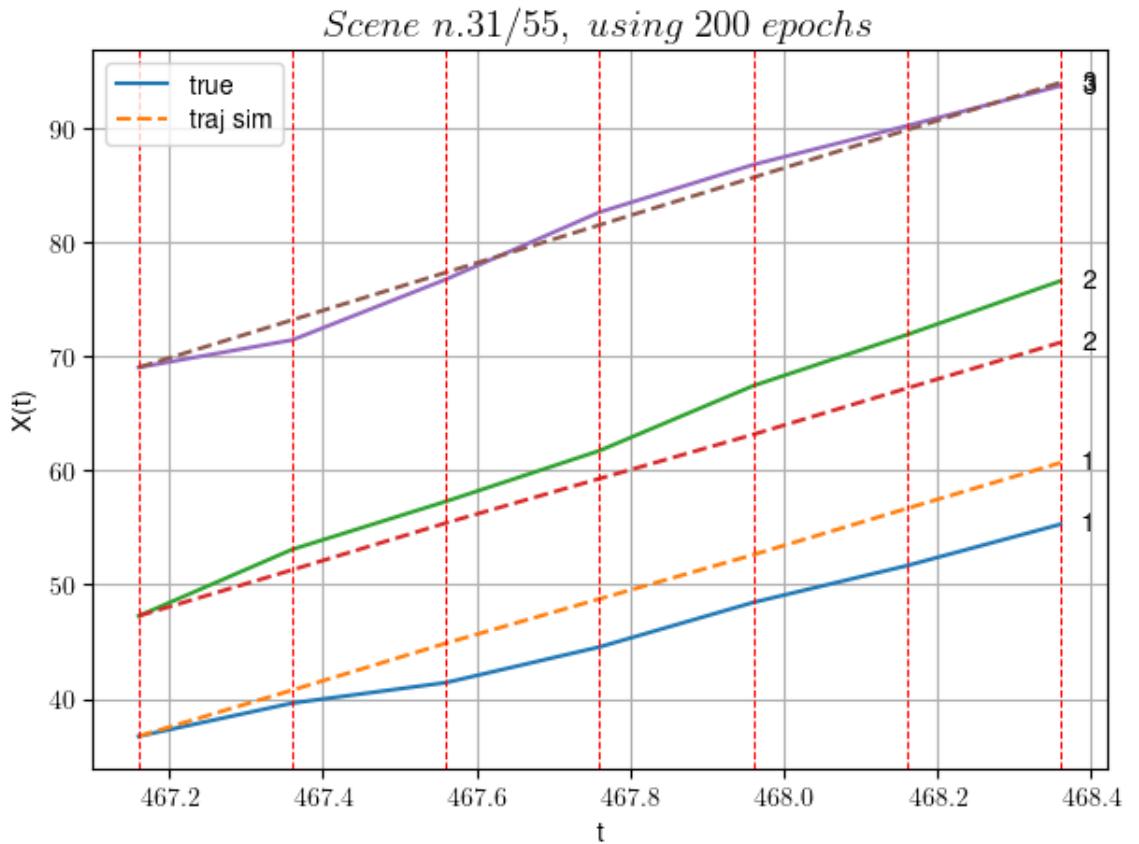
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Scene n.31/55, time interval:[467.16,468.36]

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Loss: 9.069239792360658  
v0 updated: 20.786390638769962

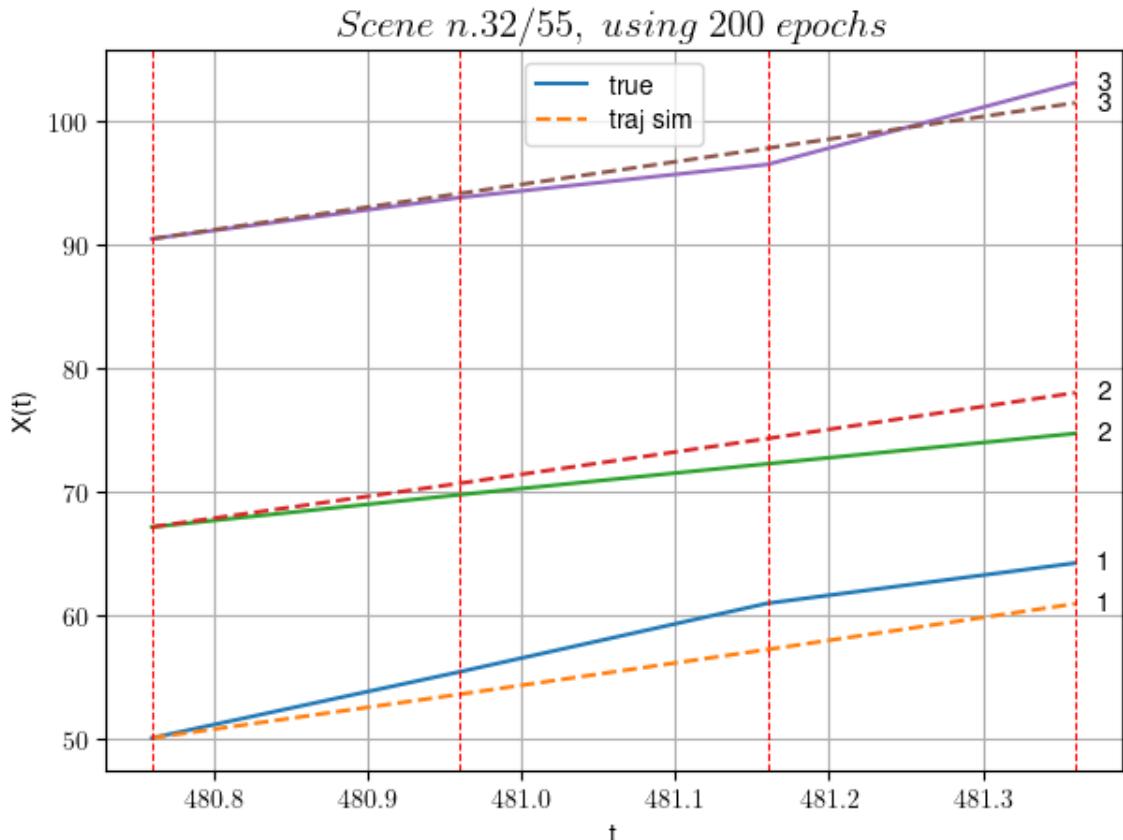
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Scene n.32/55, time interval:[480.76,481.36]

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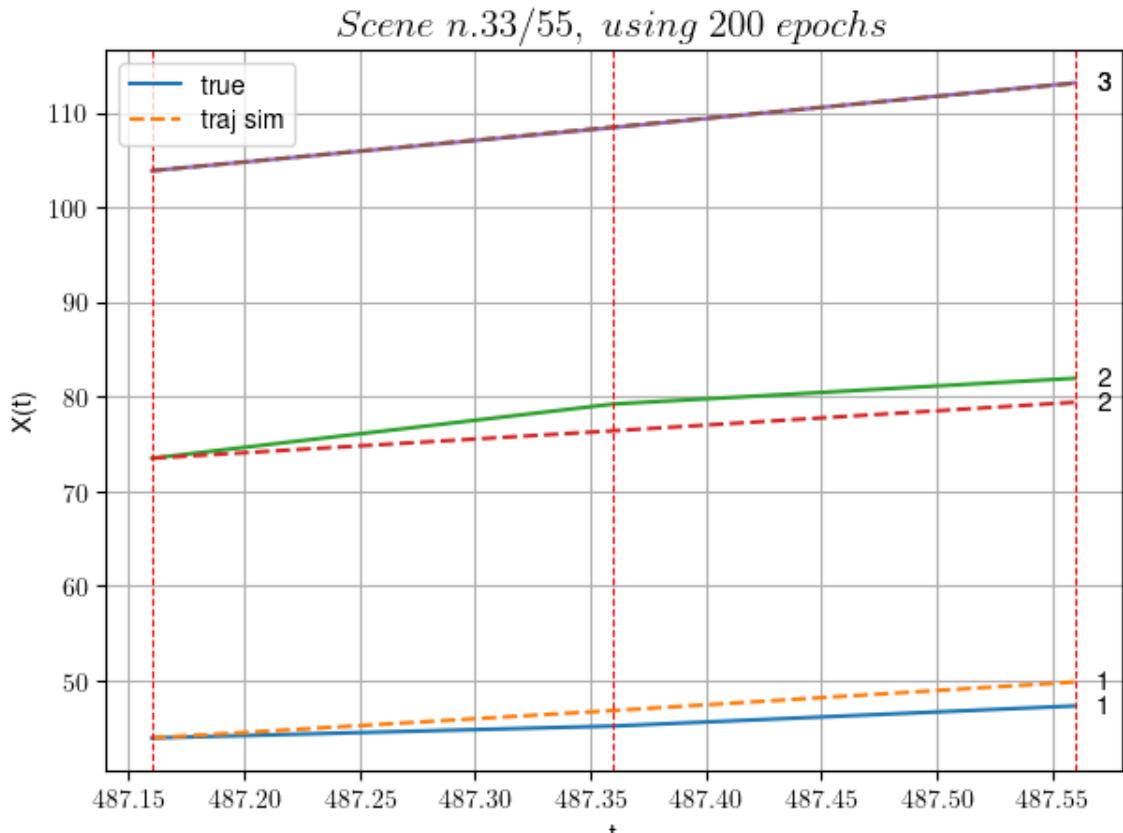


Loss: 4.030519898725794  
v0 updated: 18.31768317689234

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Scene n.33/55, time interval:[487.16,487.56]

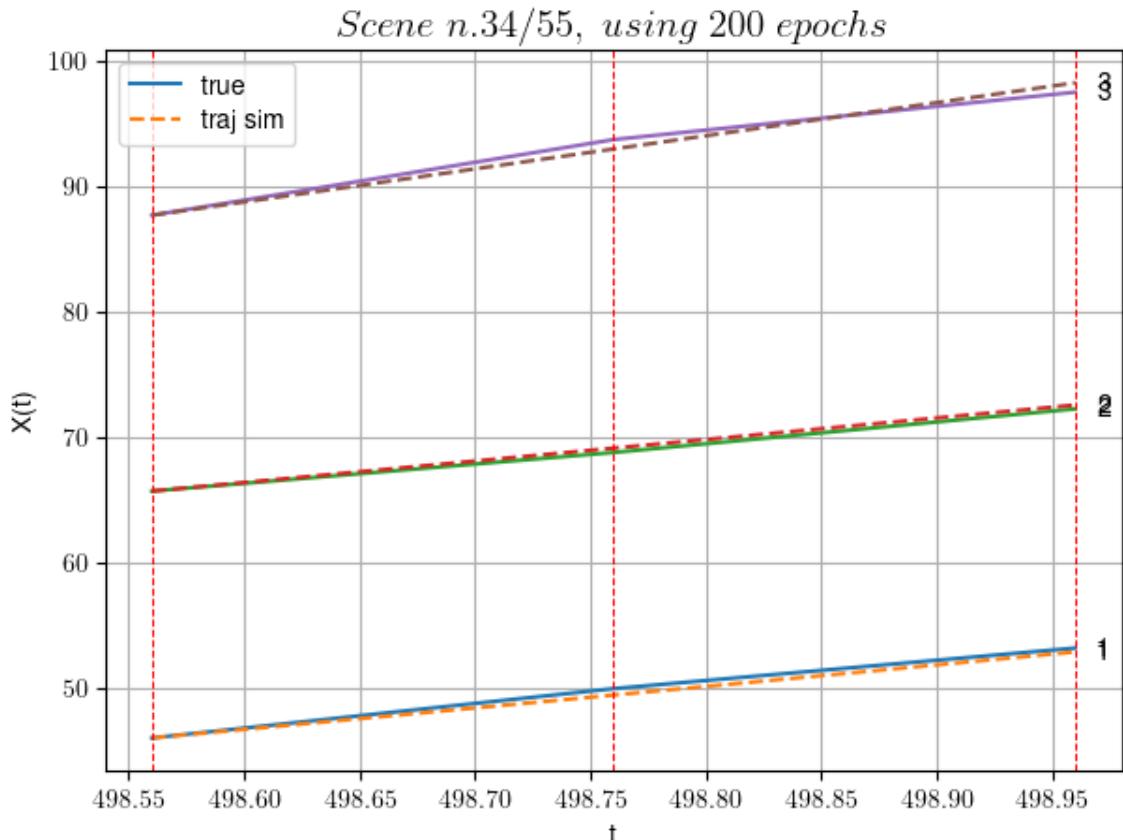
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Scene n.34/55, time interval:[498.56,498.96]

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Loss: 0.18831510634036222  
v0 updated: 26.40821113207029

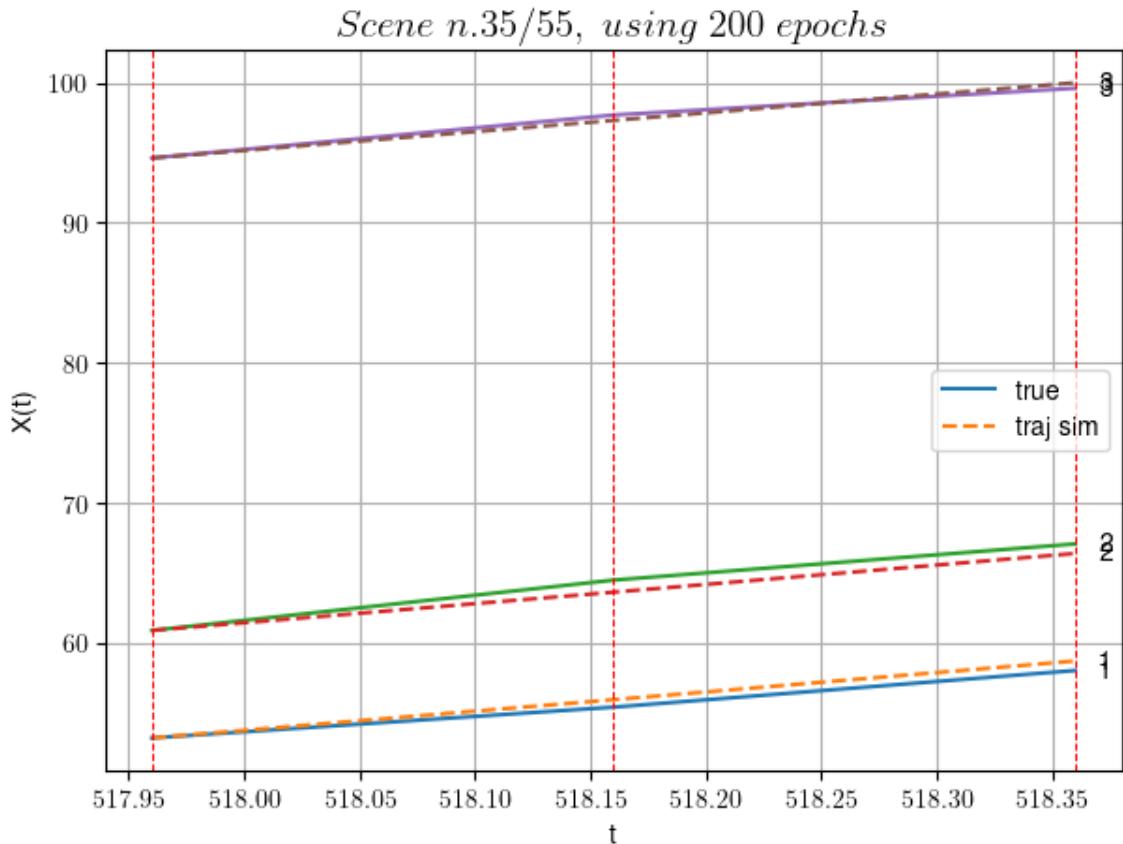
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Scene n.35/55, time interval:[517.96,518.36]

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Loss: 0.2510300759056301  
v0 updated: 13.453926468383587

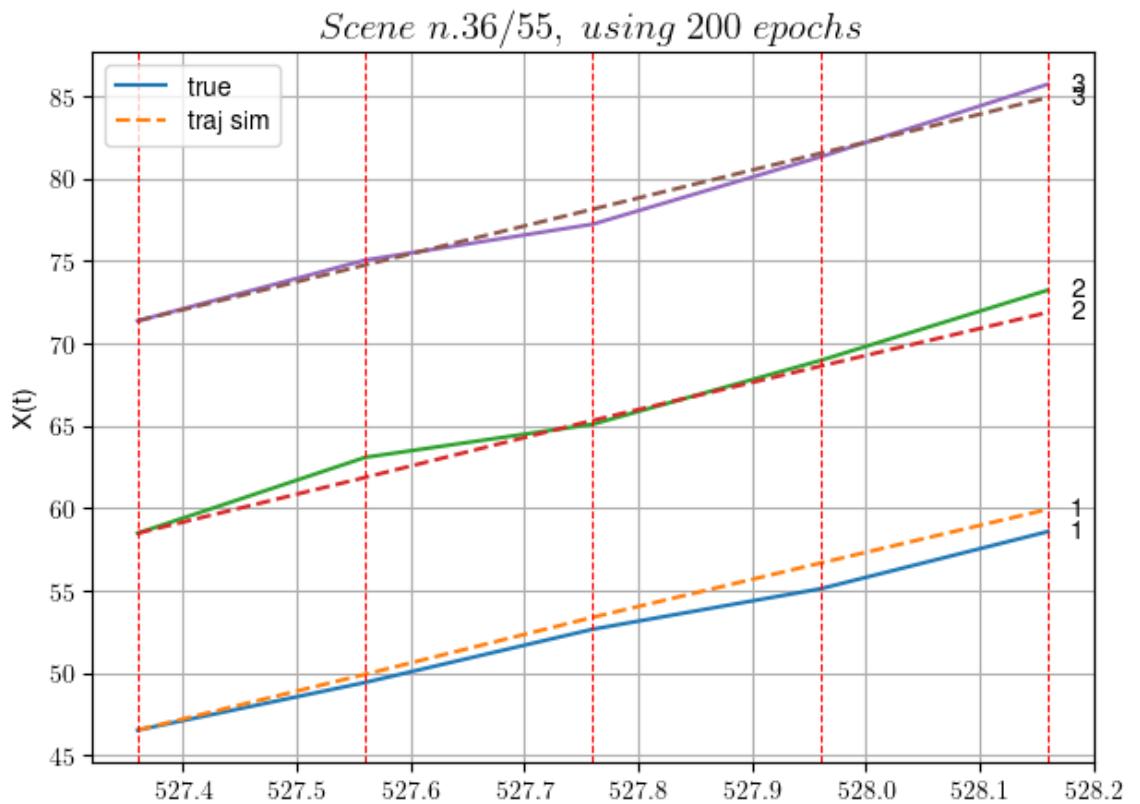
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Scene n.36/55, time interval:[527.36,528.16]

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Loss: 0.6743855766574655  
v0 updated: 16.935267042056086

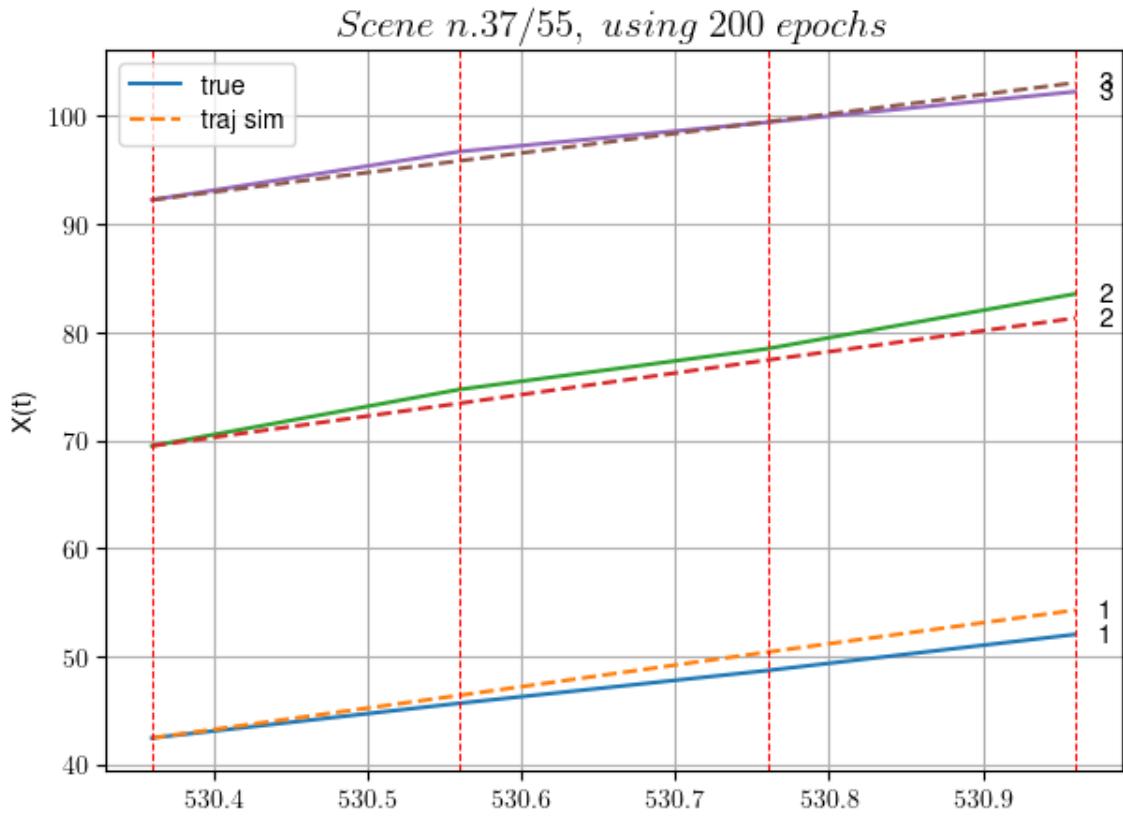
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Scene n.37/55, time interval:[530.36,530.96]

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Loss: 1.4736346805062757  
v0 updated: 18.067971080825455

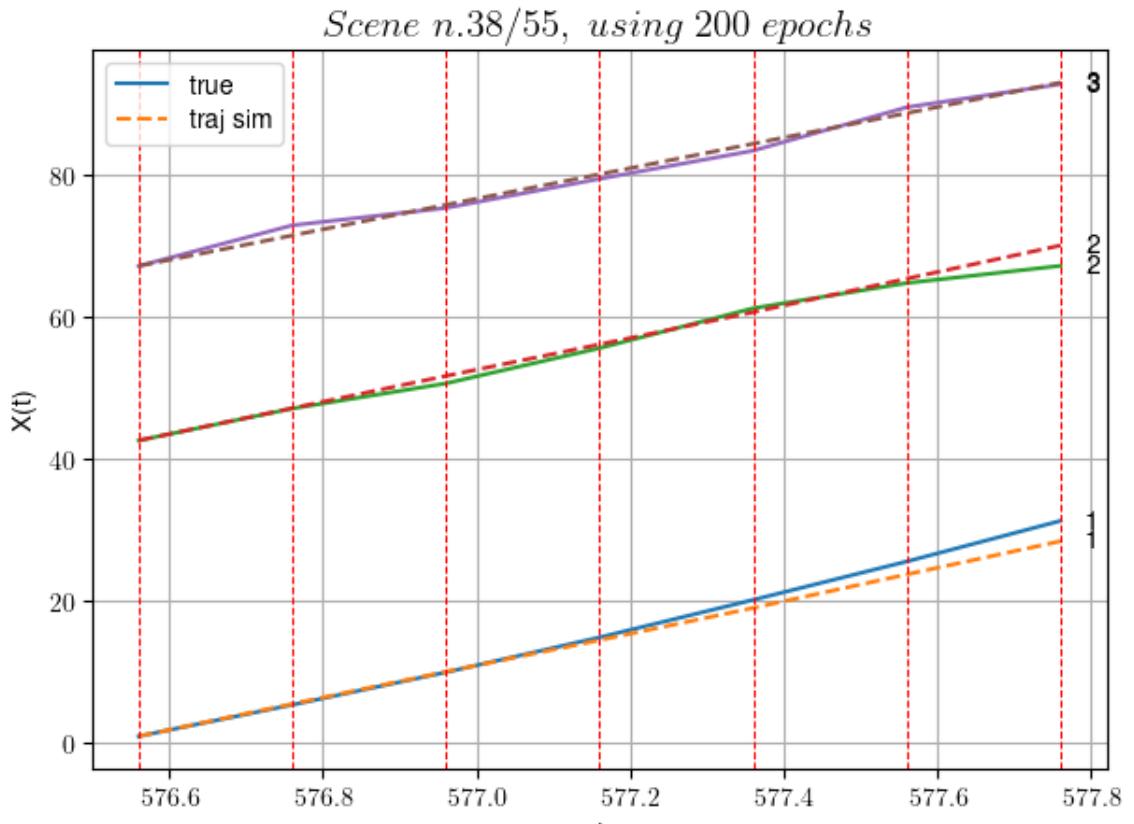
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Scene n.38/55, time interval:[576.56,577.76]

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Loss: 1.31705743883455  
v0 updated: 21.52600293608991

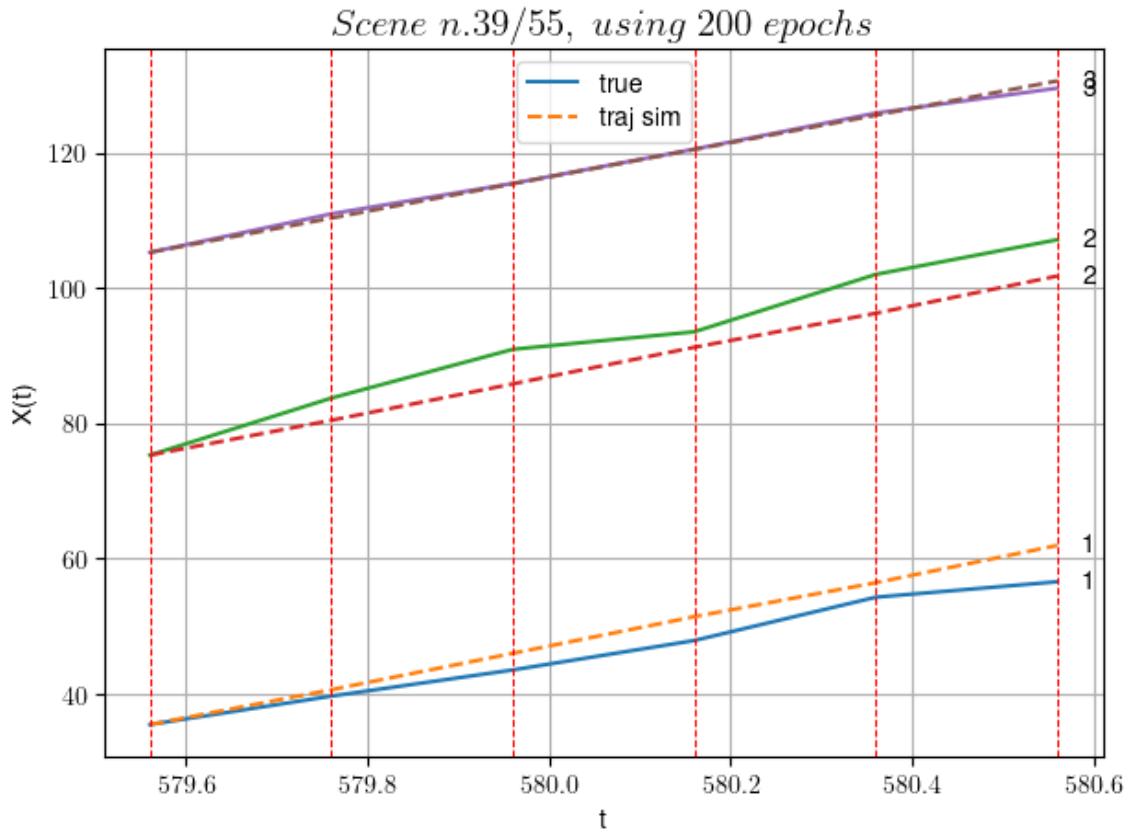
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Scene n.39/55, time interval:[579.56,580.56]

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Loss: 8.804431783625555  
v0 updated: 25.36350099714996

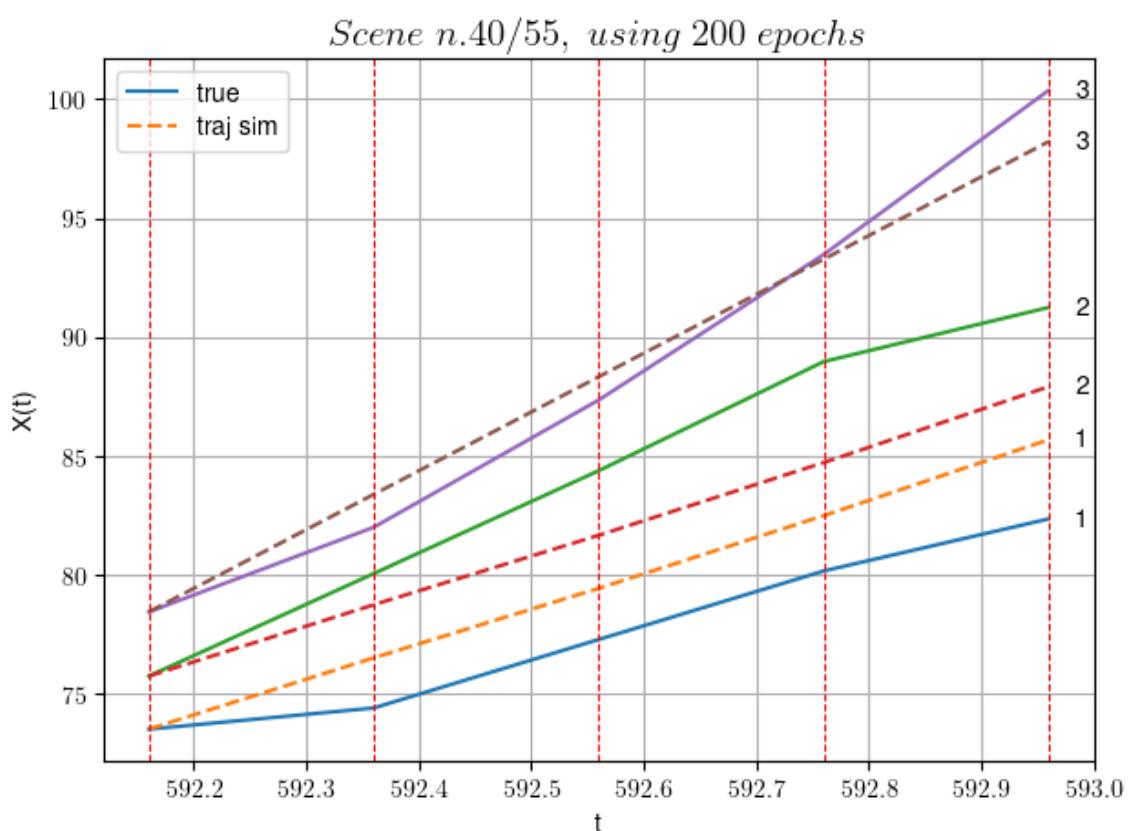
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Scene n.40/55, time interval:[592.16,592.96]

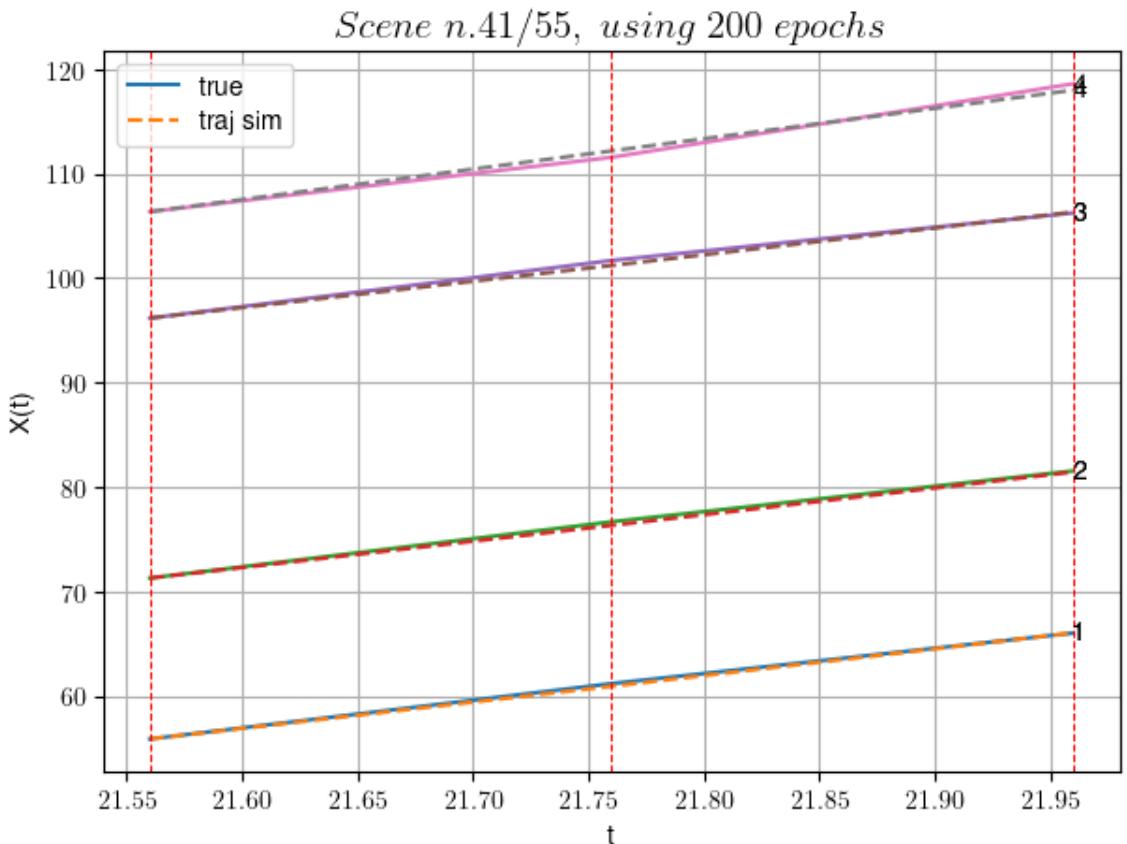
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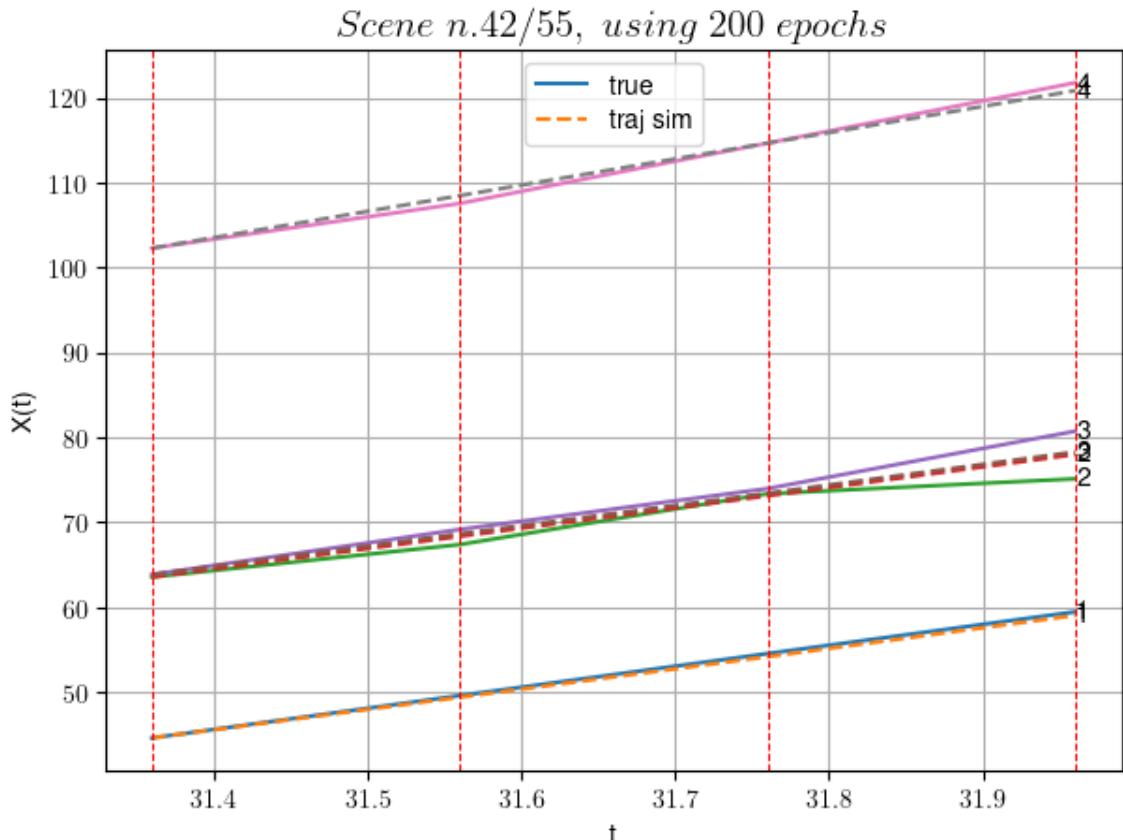
Loss: 4.7550046660533445  
v0 updated: 24.715789260210165

Scene n.41/55, time interval:[21.56,21.96]



Loss: 0.09877804499328294  
v0 updated: 29.08930460717769

Scene n.42/55, time interval:[31.36,31.96]



Loss: 1.1128590884531466  
v0 updated: 30.911522722567767

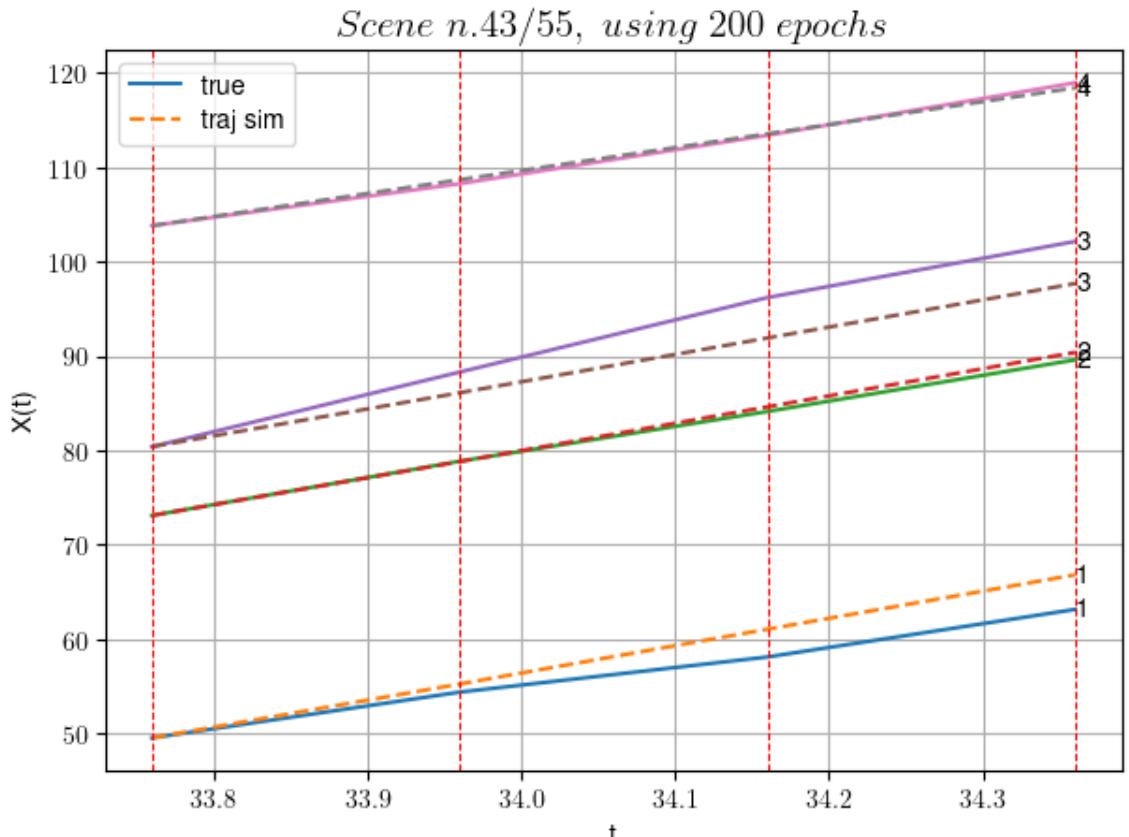
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Scene n.43/55, time interval:[33.76,34.36]

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Loss: 4.203071994227673  
v0 updated: 24.350672666072207

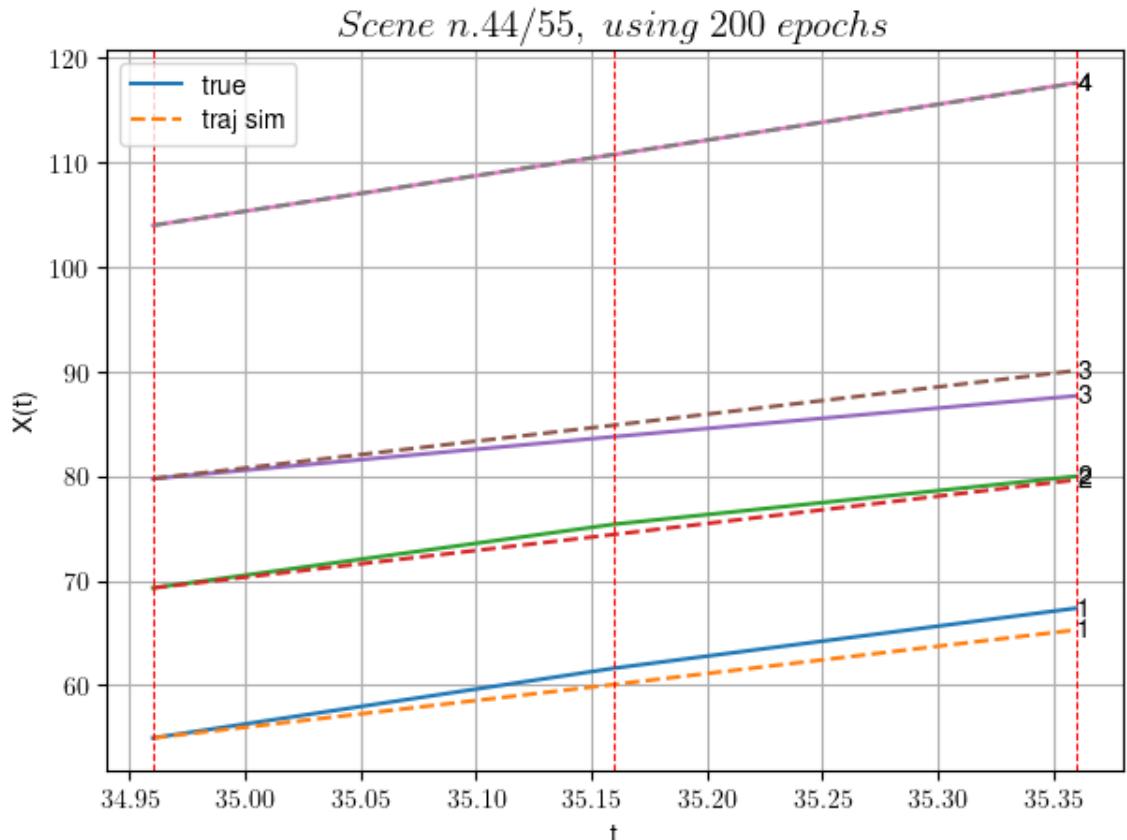
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Scene n.44/55, time interval:[34.96,35.36]

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Loss: 1.2378703185576205  
v0 updated: 34.01960344941417

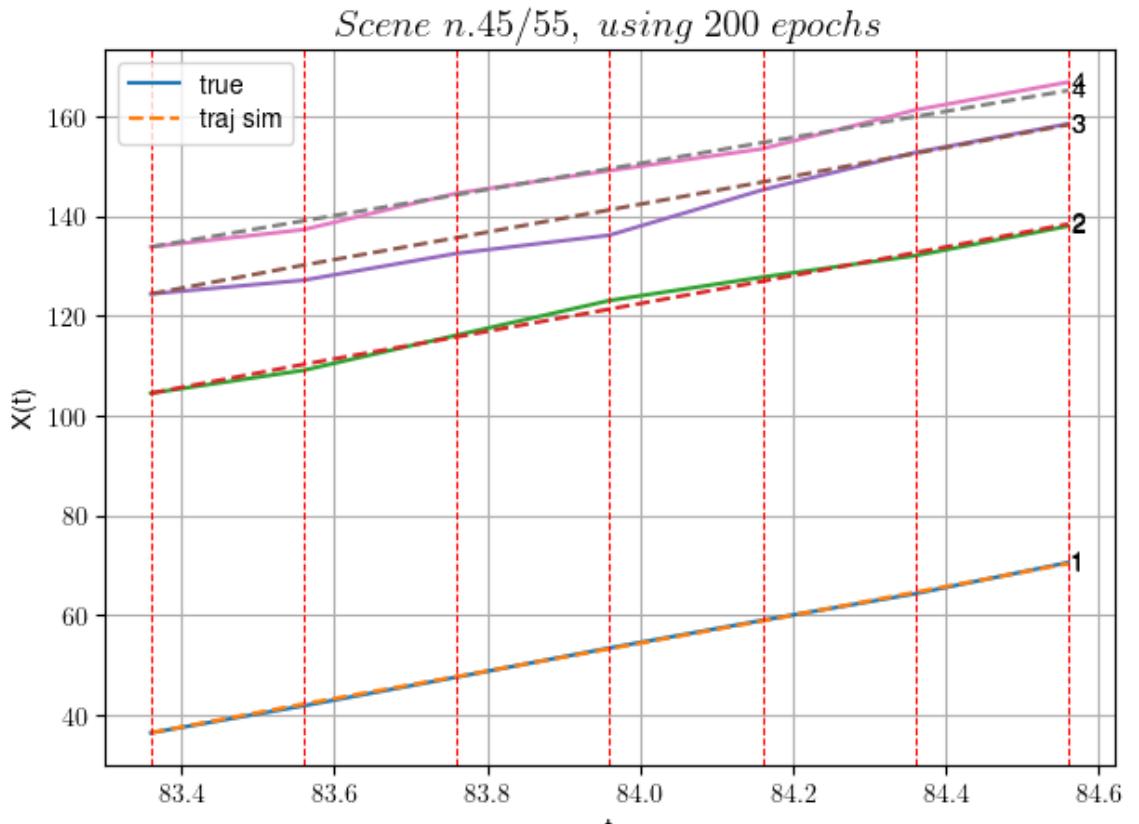
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Scene n.45/55, time interval:[83.36,84.56]

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Loss: 2.249874666033817  
v0 updated: 26.131707170269824

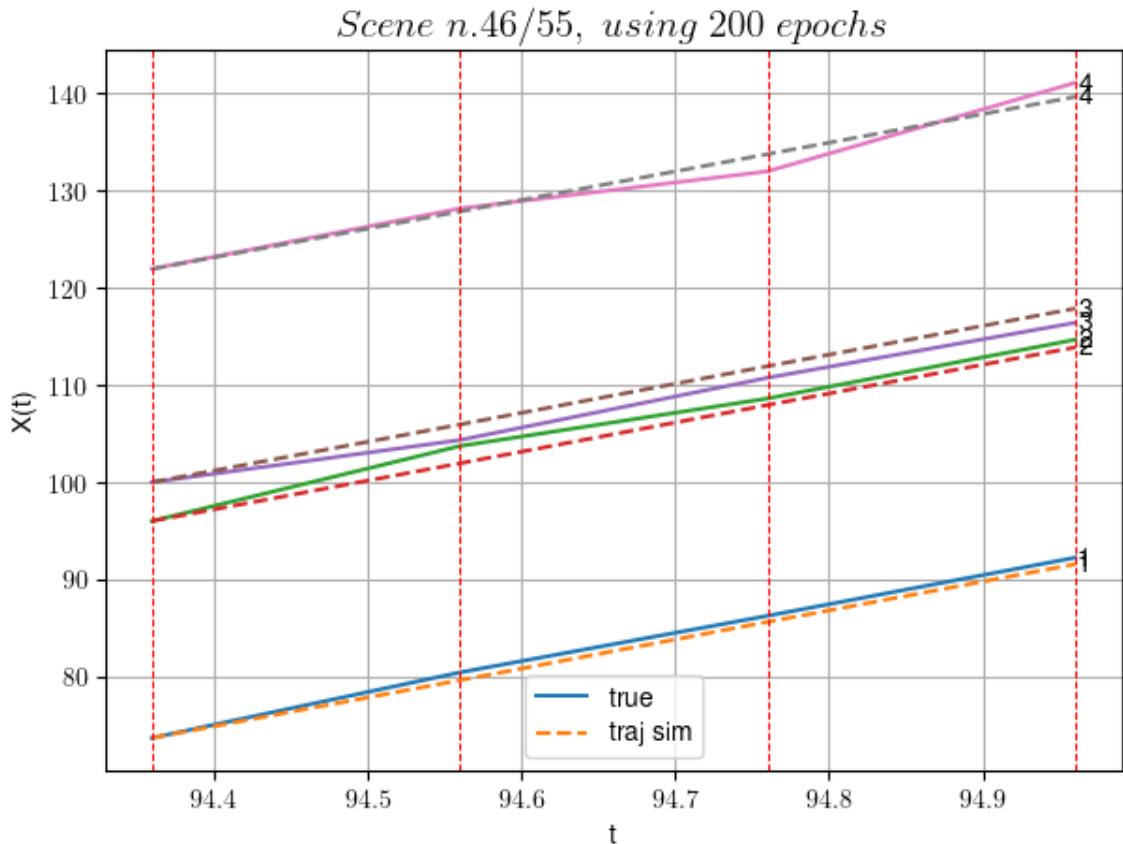
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Scene n.46/55, time interval:[94.36, 94.96]

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Loss: 1.0726299940090924  
v0 updated: 29.529075741854022

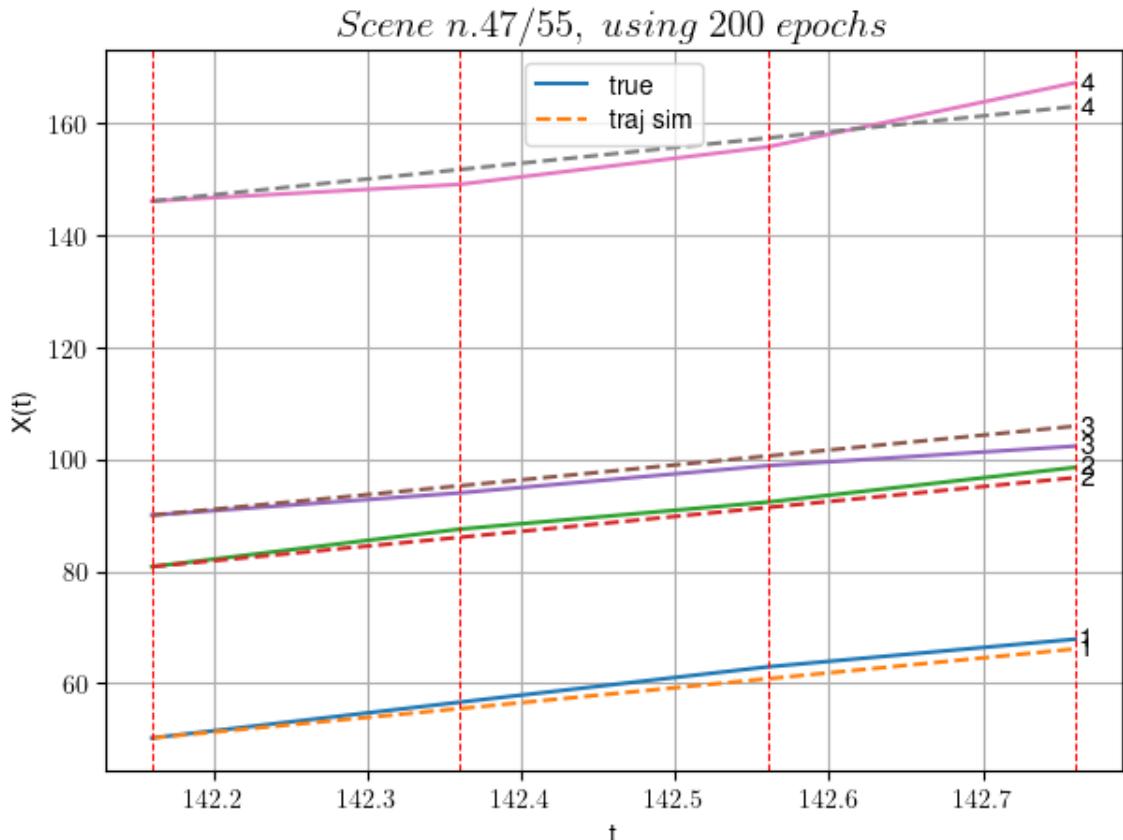
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Scene n.47/55, time interval:[142.16,142.76]

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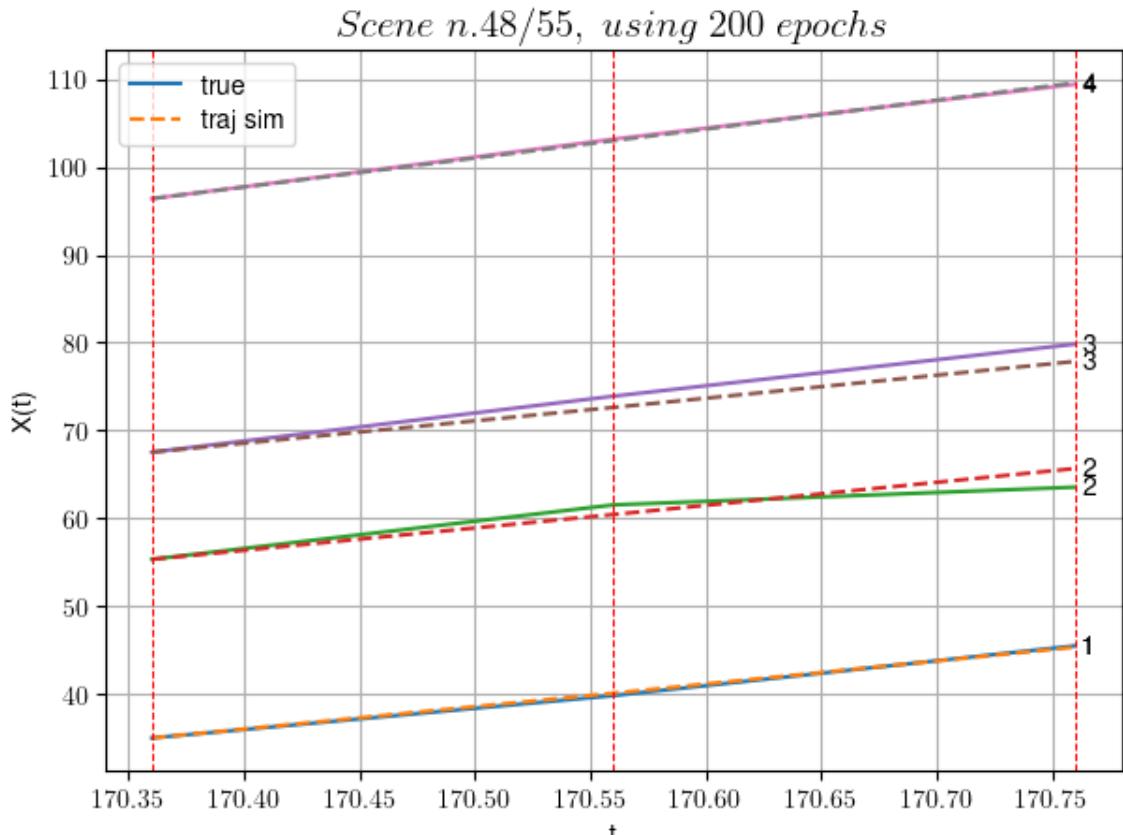


Loss: 3.753000128471376  
v0 updated: 28.13281408756362

---

Scene n.48/55, time interval:[170.36,170.76]

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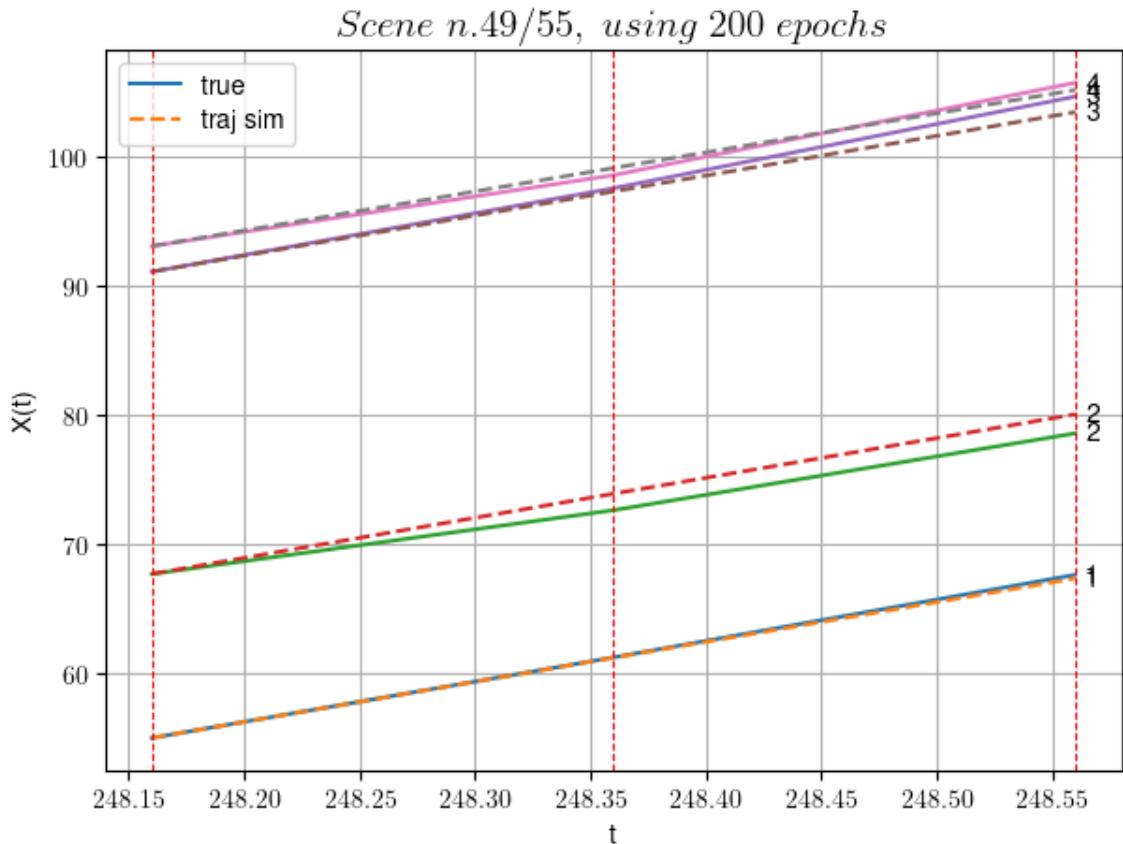


Loss: 0.946580330466954  
v0 updated: 32.978076203930534

---

Scene n.49/55, time interval:[248.16,248.56]

---



Loss: 0.5004547631809666  
v0 updated: 30.24743653164149

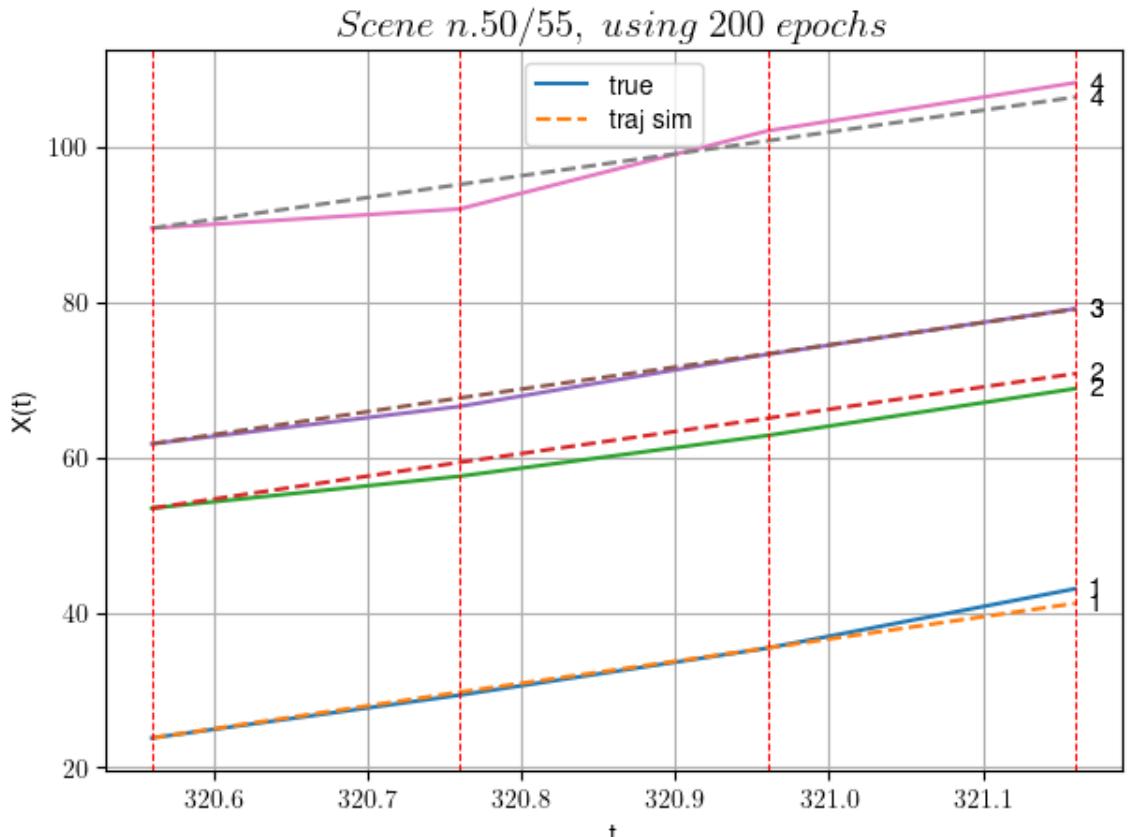
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Scene n.50/55, time interval:[320.56,321.16]

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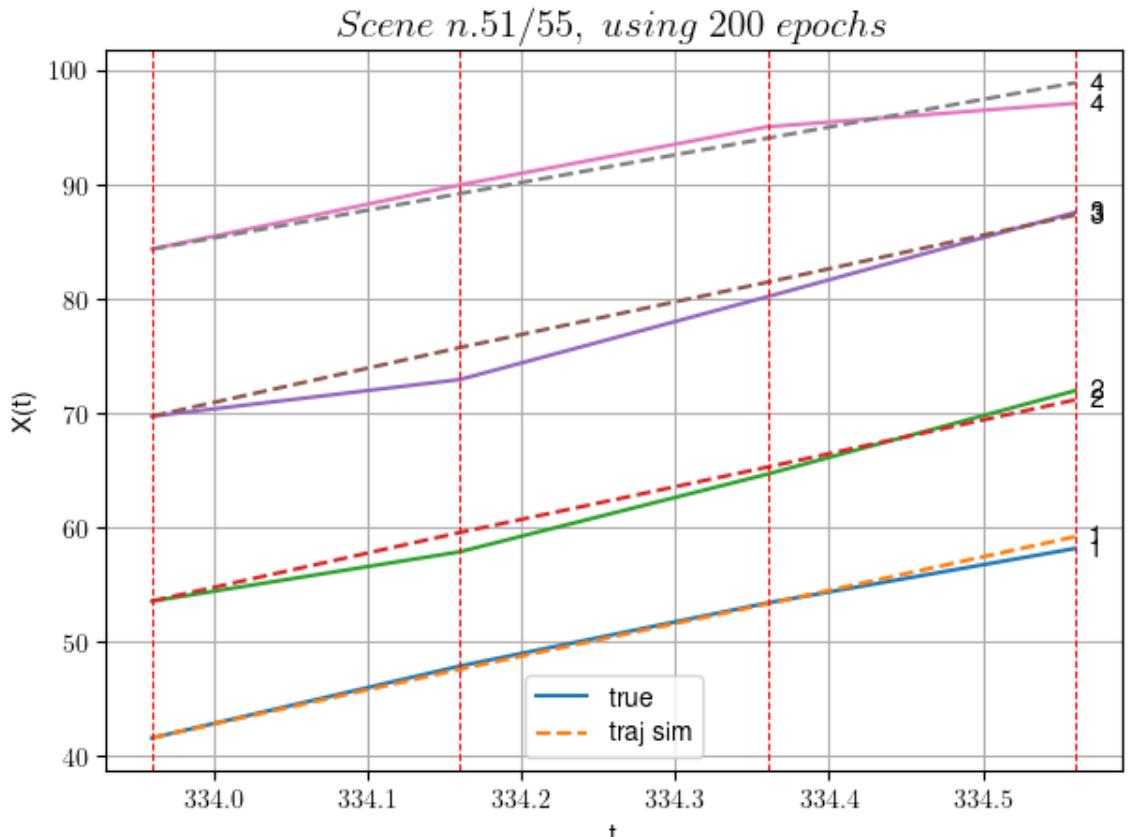


Loss: 1.9843200432195982  
v0 updated: 28.141662429457412

---

Scene n.51/55, time interval:[333.96,334.56]

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Loss: 1.2044664304797075  
v0 updated: 24.25439744624117

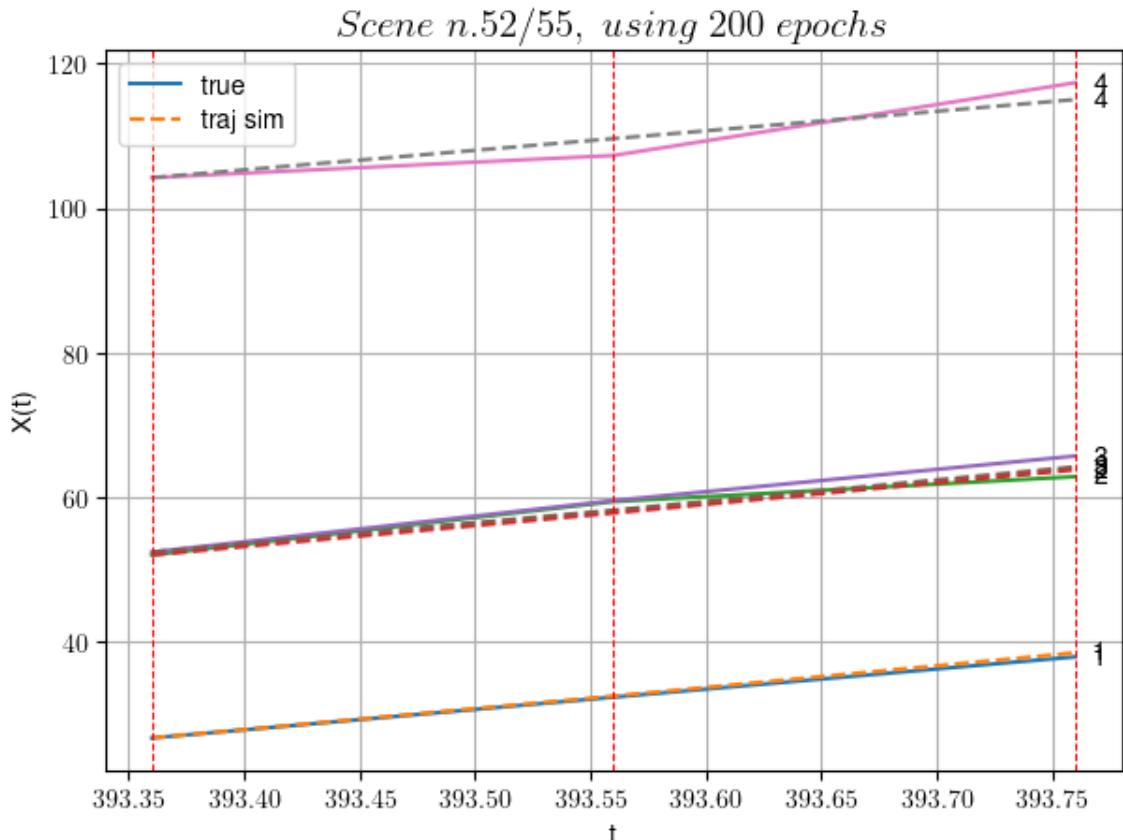
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Scene n.52/55, time interval:[393.36,393.76]

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Loss: 1.5558382757659808  
v0 updated: 27.02473980917819

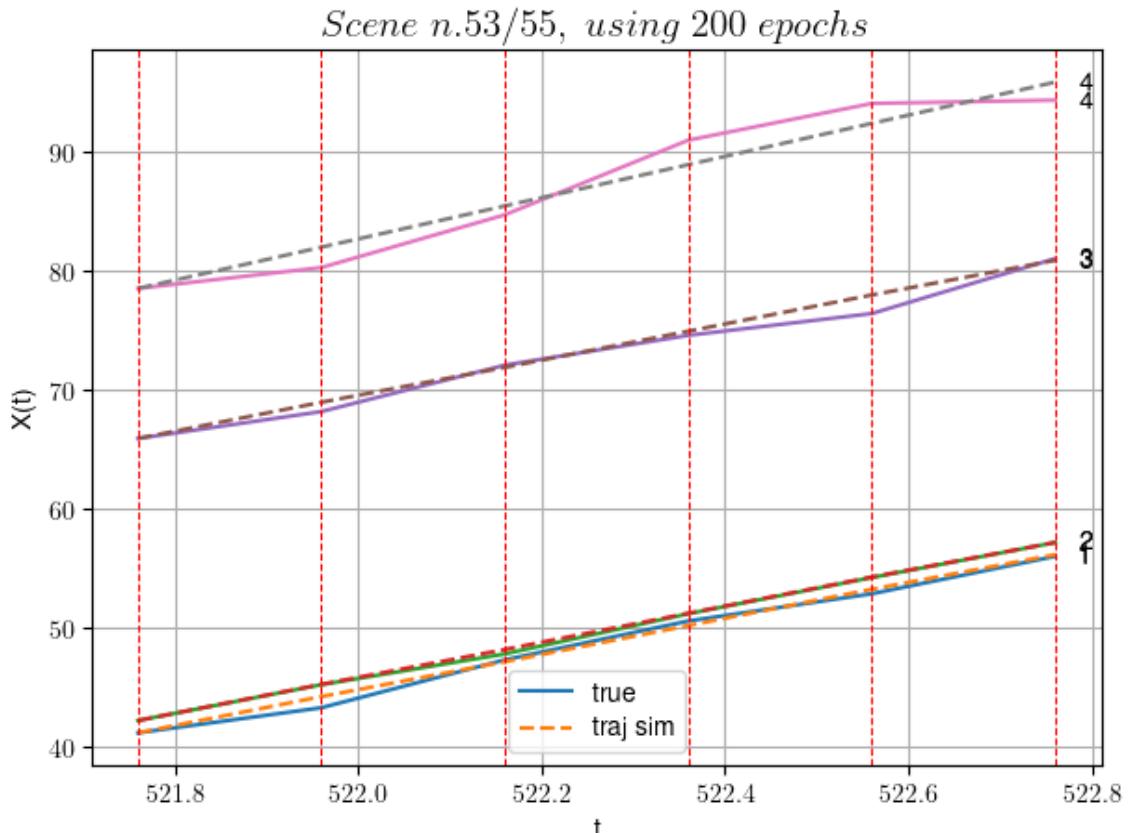
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Scene n.53/55, time interval:[521.76,522.76]

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Loss: 0.7236763350461666  
v0 updated: 17.326362767836482

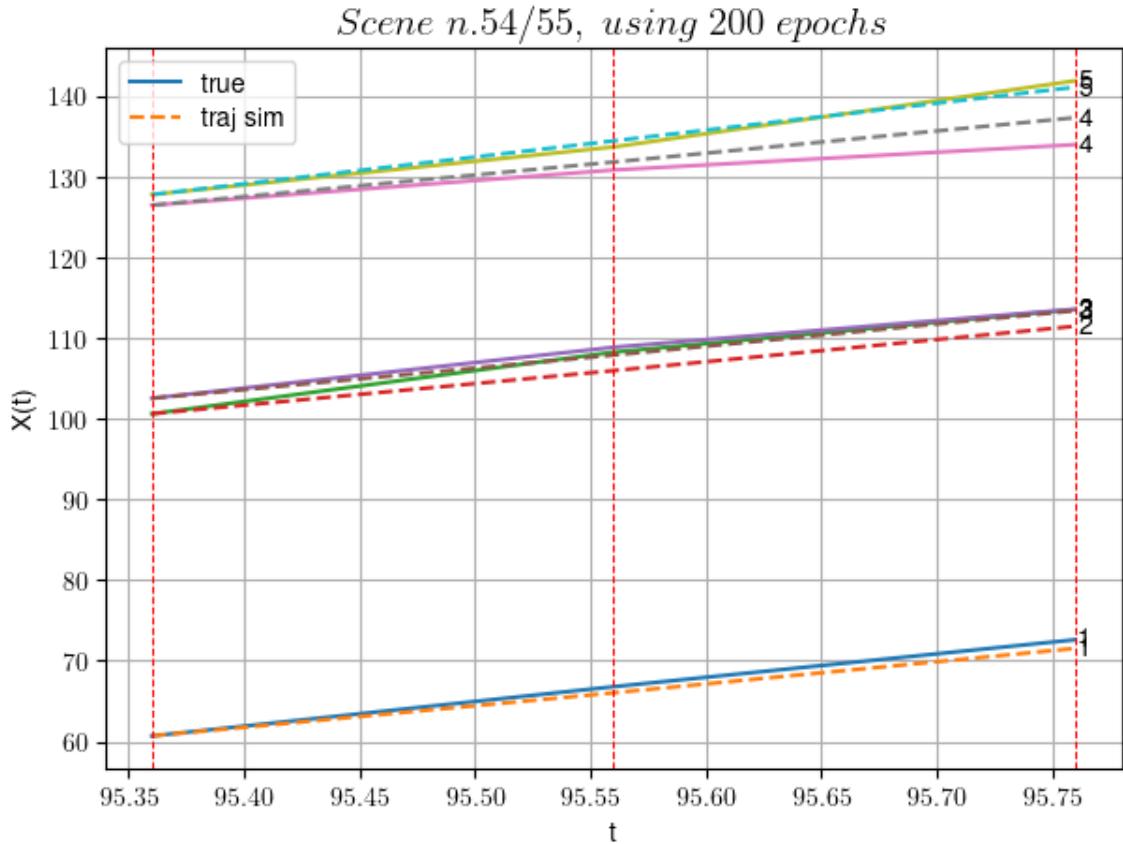
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---

Scene n.54/55, time interval:[95.36,95.76]

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---



Loss: 1.7090957246965963  
 $v_0$  updated: 33.29374725104888

---

```
v0_mean in this df is: 28.553527636062597
Time taken: 317.55s
Hidden-Layer-1/kernel:0: [-1.0315088e+01 -7.4801631e+00 -1.
2637139e+05 -6.0159552e+02]
Hidden-Layer-1/bias:0: [ -9.180831      -7.2036943 -6253.4644
-341.692 ]
Output-Layer/kernel:0: [-1.7920527e+00  4.7746301e+00 -1.5931100
e+05  1.4249943e+01]
Output-Layer/bias:0: [26.753752]
```

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In df n.4/10 we have 30 scenes

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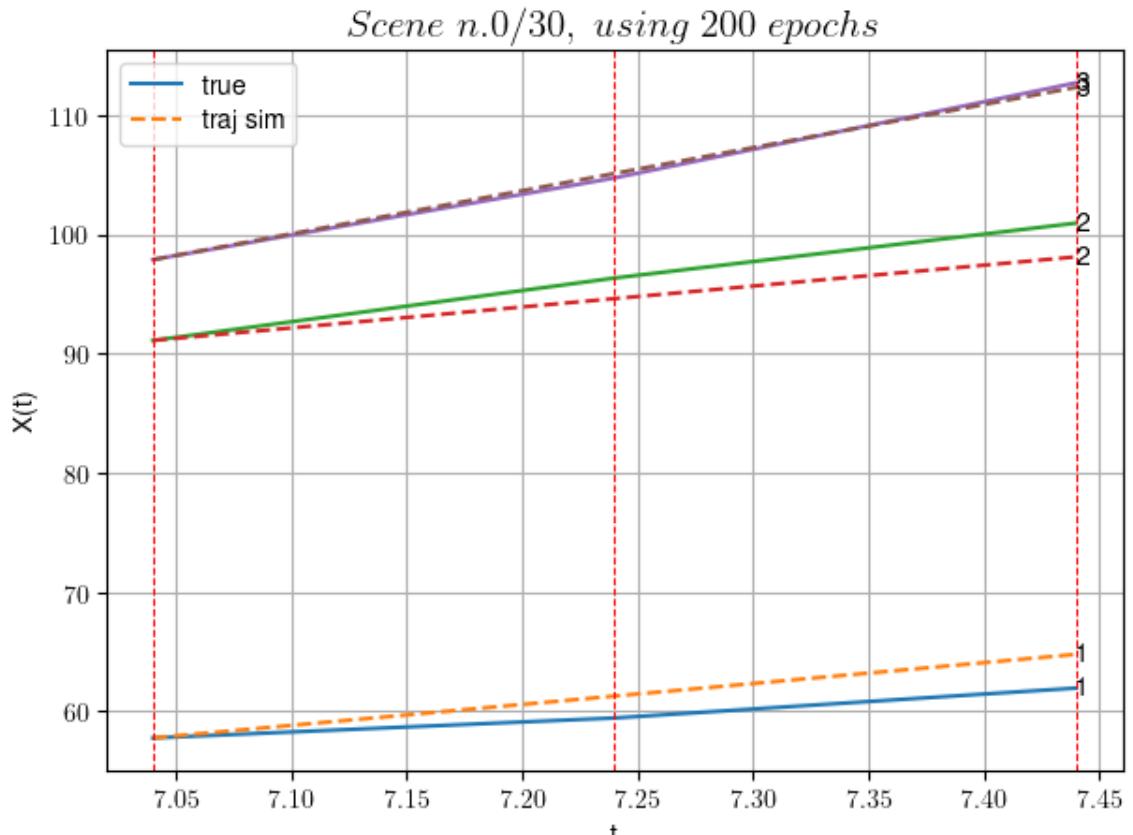
---



---

Scene n.0/30, time interval:[7.04,7.44]

---



Loss: 2.51731066638844  
v0 updated: 36.147472929252125

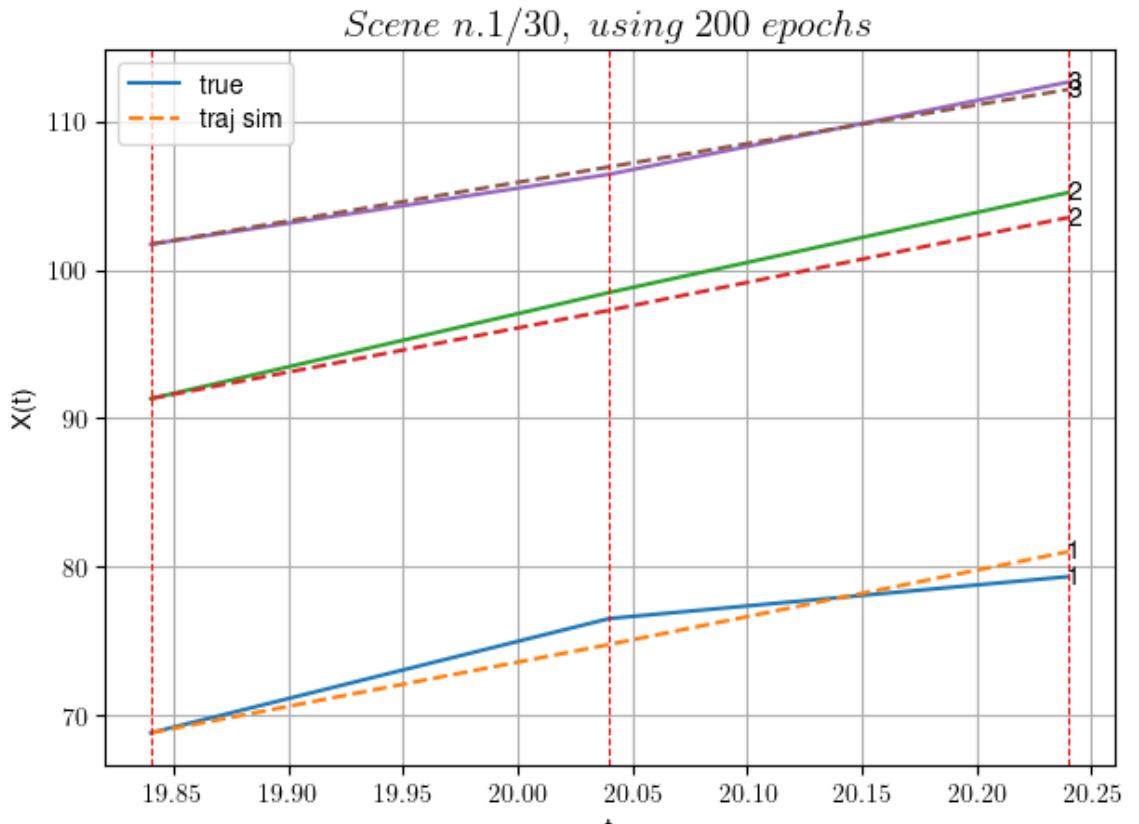
---

---

Scene n.1/30, time interval:[19.84,20.24]

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---



Loss: 1.1812223205455992  
v0 updated: 26.06329397762493

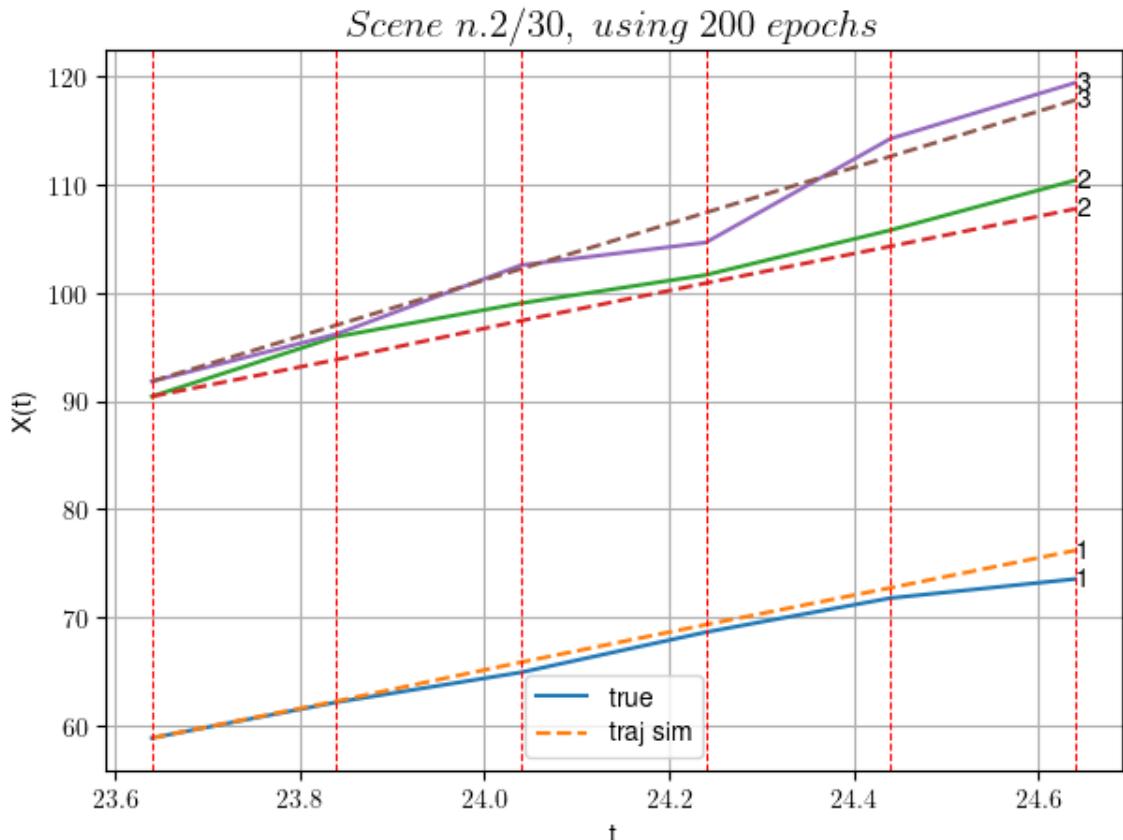
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---

Scene n.2/30, time interval:[23.64,24.64]

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---



Loss: 2.2088498589555576  
v0 updated: 25.978995529036656

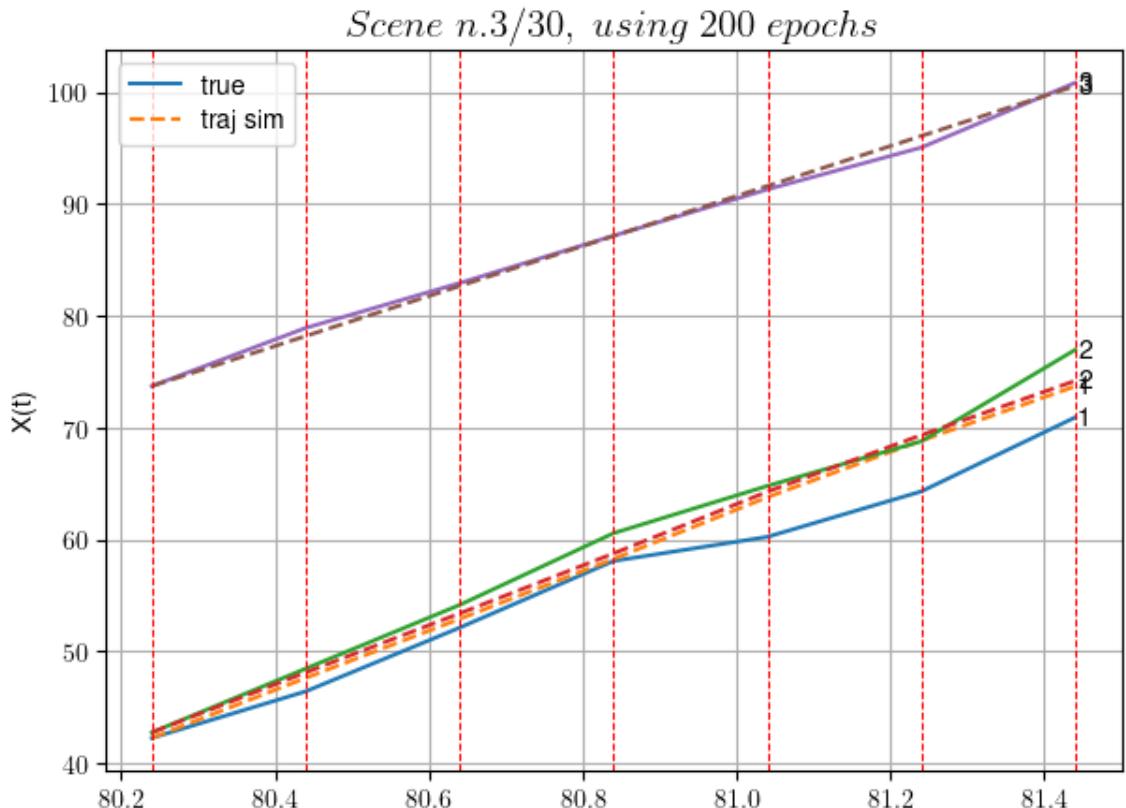
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---

Scene n.3/30, time interval:[80.24,81.44]

---

---



Loss: 2.7241593041960823  
v0 updated: 22.376154559314973

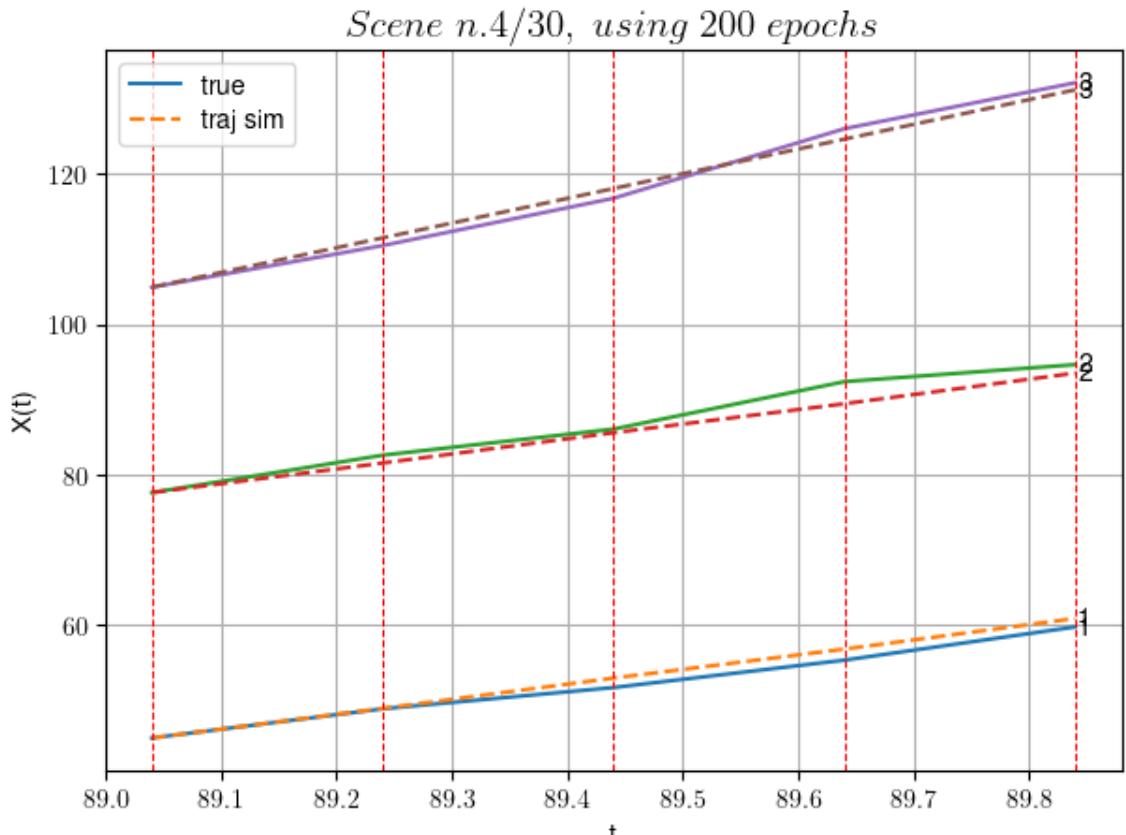
---

---

Scene n.4/30, time interval:[89.04,89.84]

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---



Loss: 1.4451992409952048  
v0 updated: 32.77238417172515

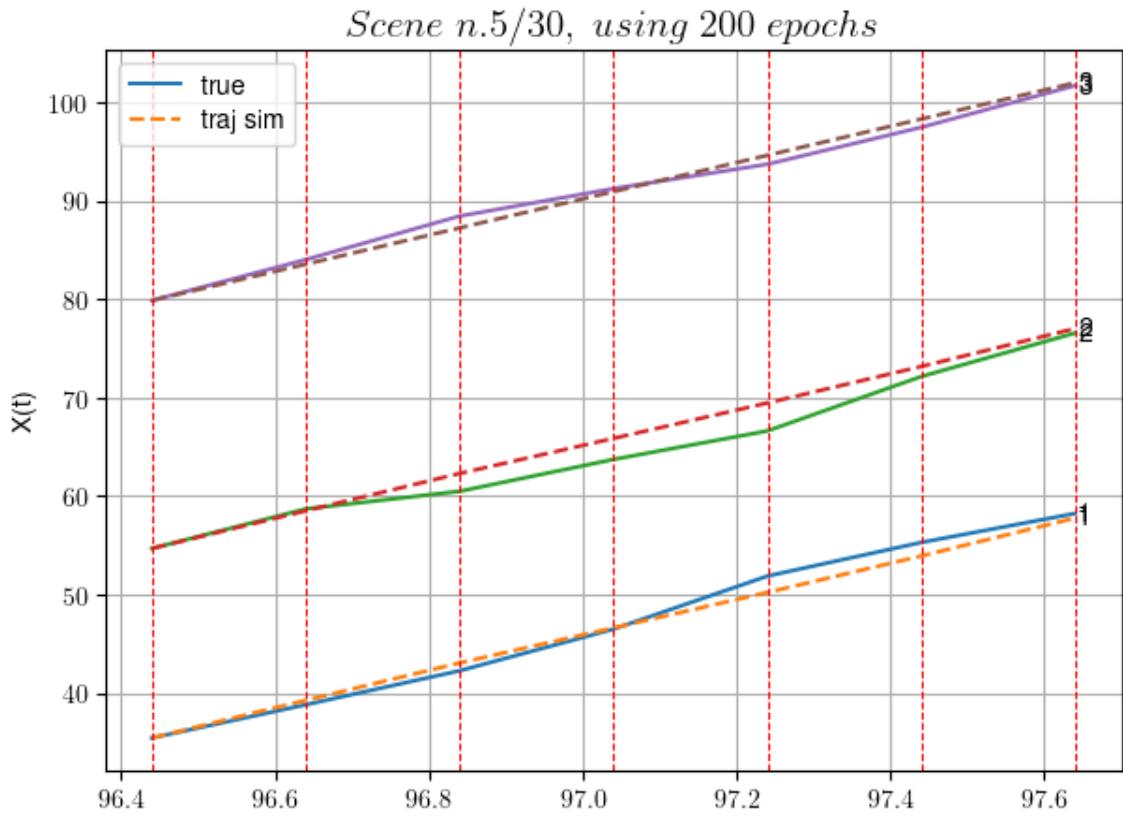
---

---

Scene n.5/30, time interval:[96.44,97.64]

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---



Loss: 1.2476979579362057  
v0 updated: 18.41401615430983

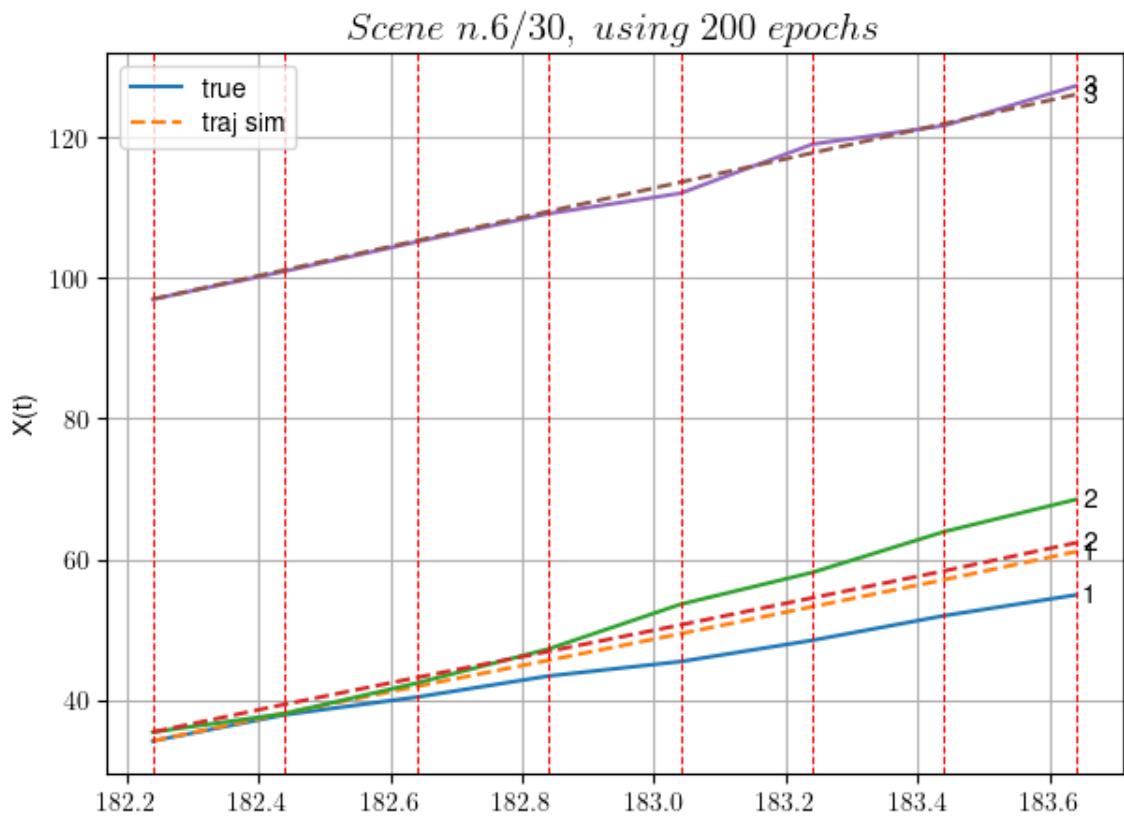
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Scene n.6/30, time interval:[182.24,183.64]

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---



Loss: 8.687185252137299  
v0 updated: 20.783330716965185

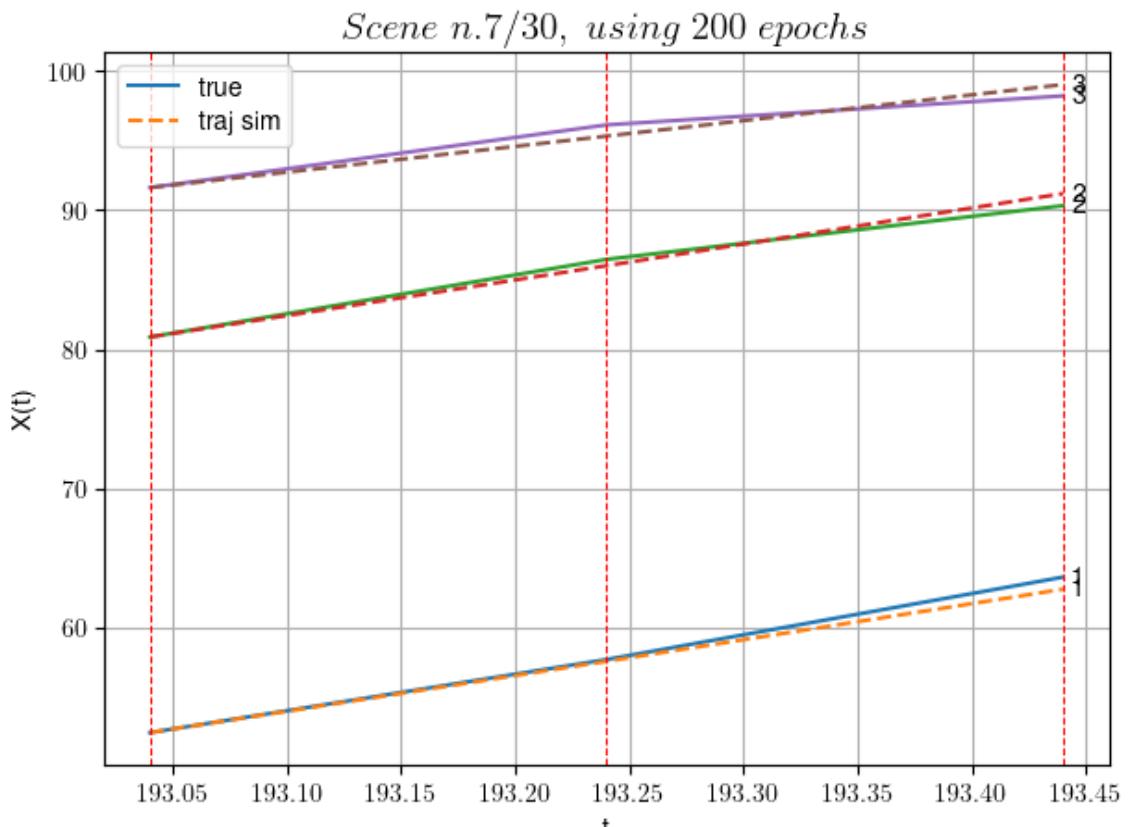
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Scene n.7/30, time interval:[193.04,193.44]

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Loss: 0.3385878927494493  
v0 updated: 18.519148732885238

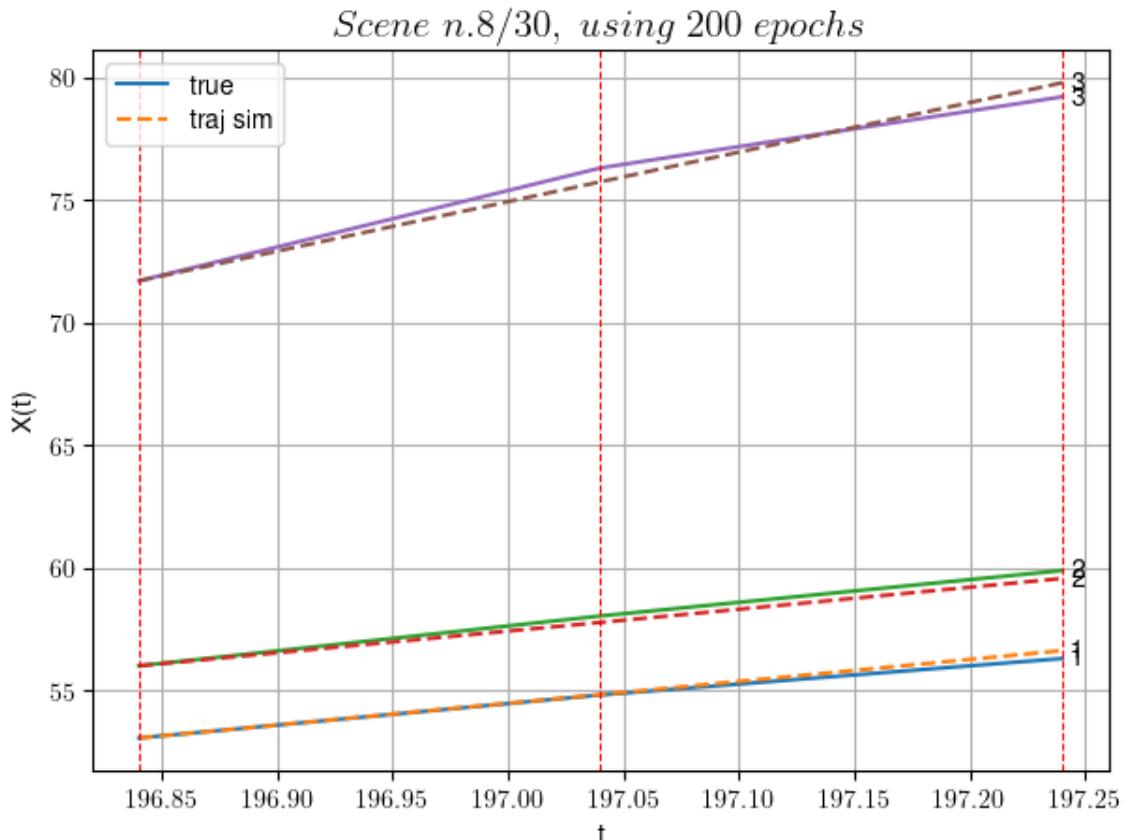
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Scene n.8/30, time interval:[196.84,197.24]

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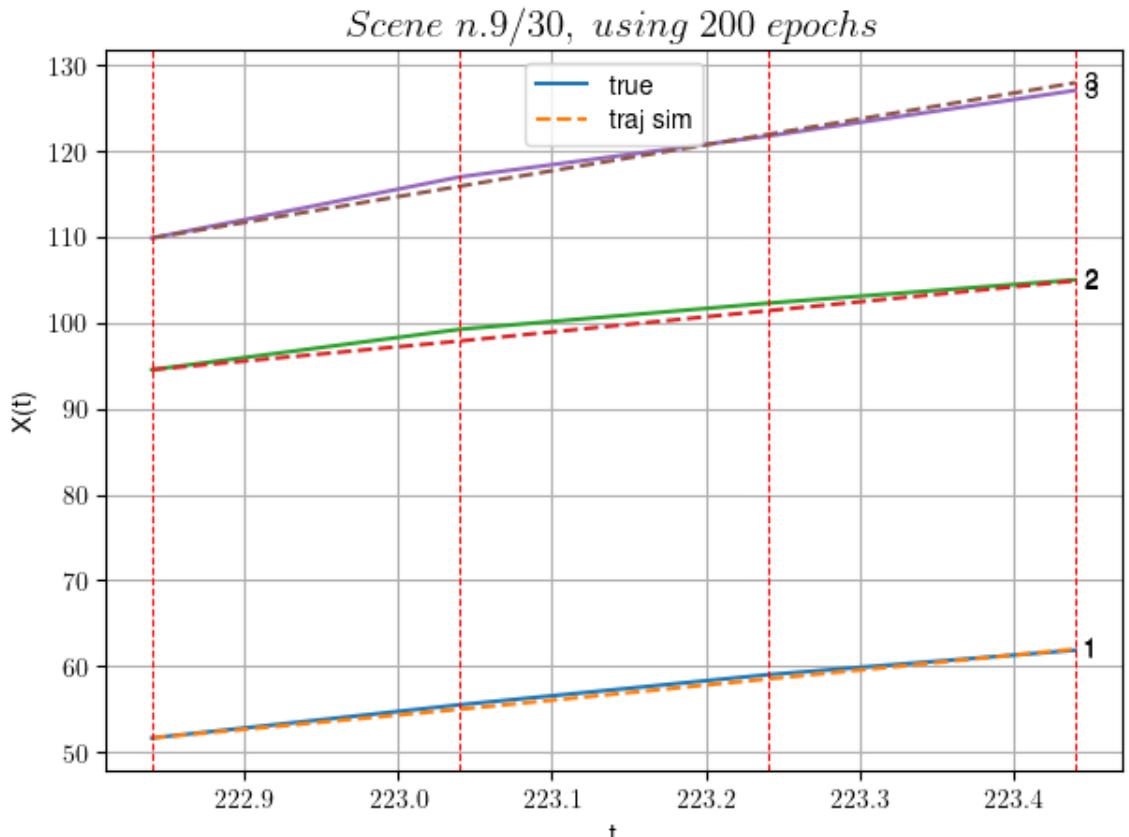
Loss: 0.10307610701439758  
v0 updated: 20.19954608763423

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Scene n.9/30, time interval:[222.84,223.44]

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Loss: 0.4323442679177338  
v0 updated: 30.107810155620577

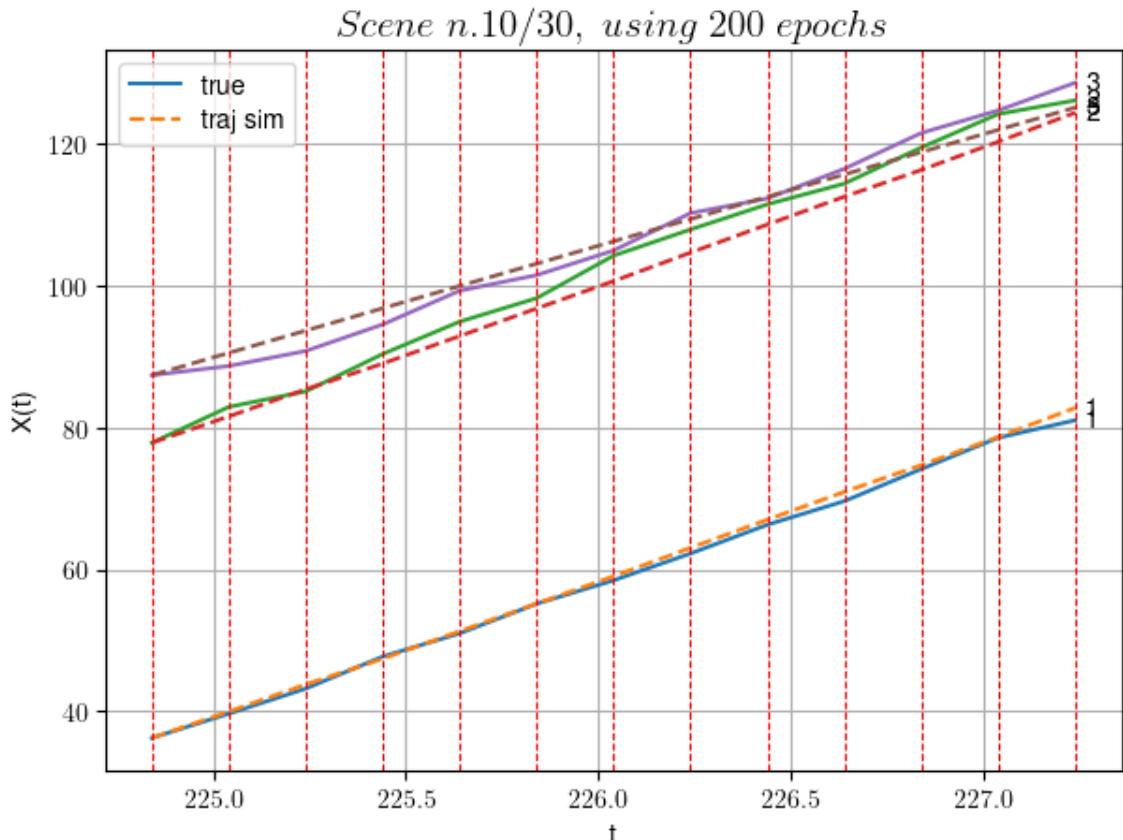
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Scene n.10/30, time interval:[224.84,227.24]

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Loss: 3.3473876248733845  
v0 updated: 15.729363702731447

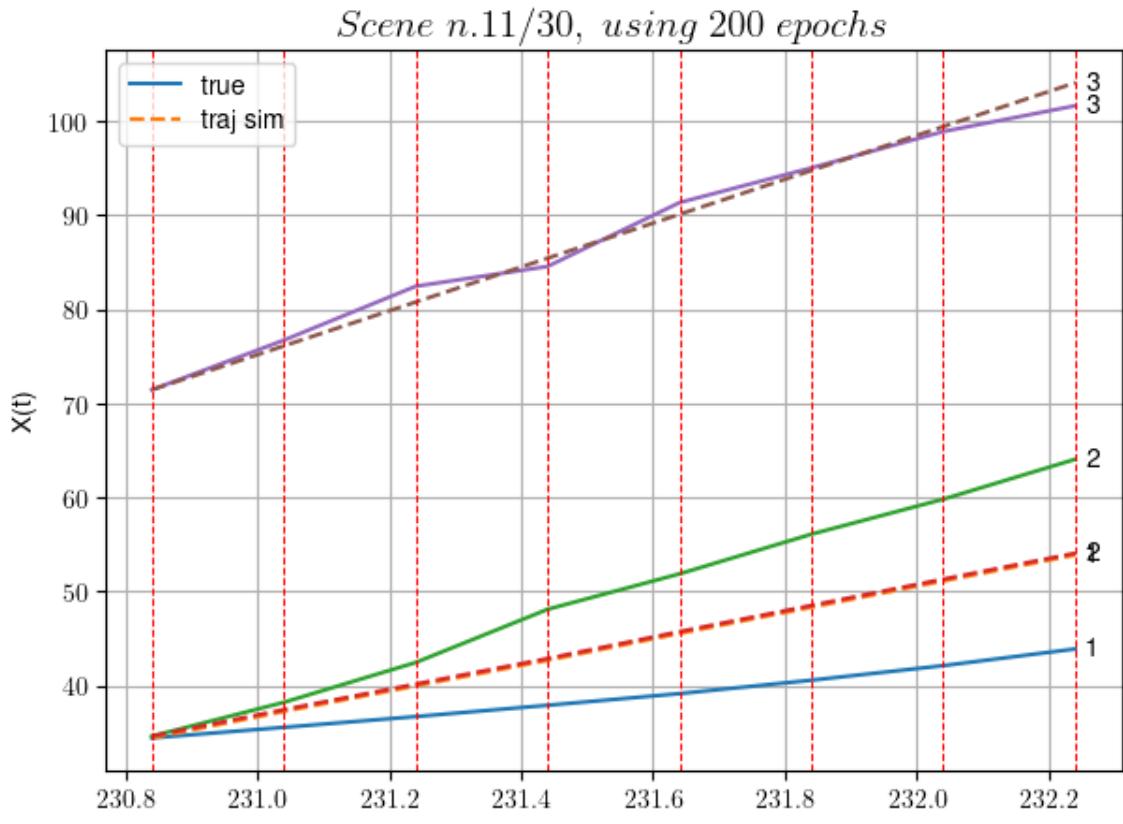
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Scene n.11/30, time interval:[230.84,232.24]

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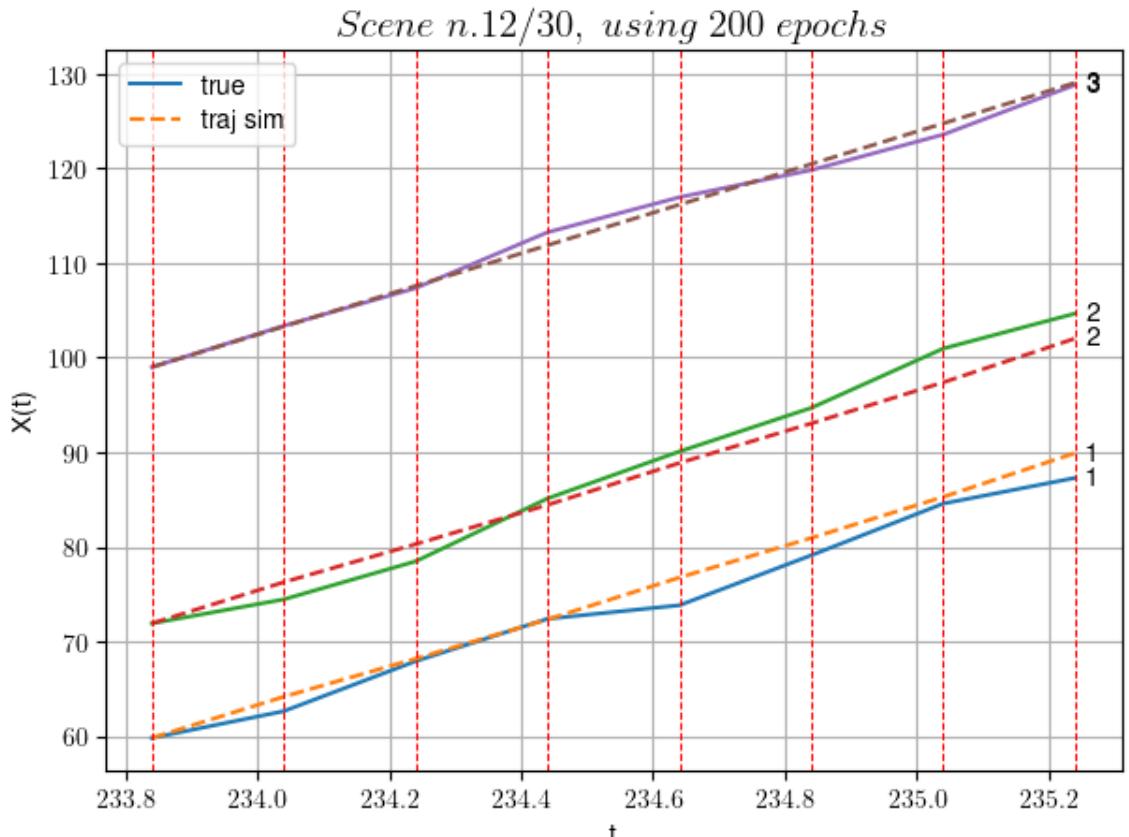


Loss: 26.298826687179147  
v0 updated: 23.3300547416105

---

Scene n.12/30, time interval:[233.84,235.24]

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Loss: 2.381703925285695  
v0 updated: 21.472180424121877

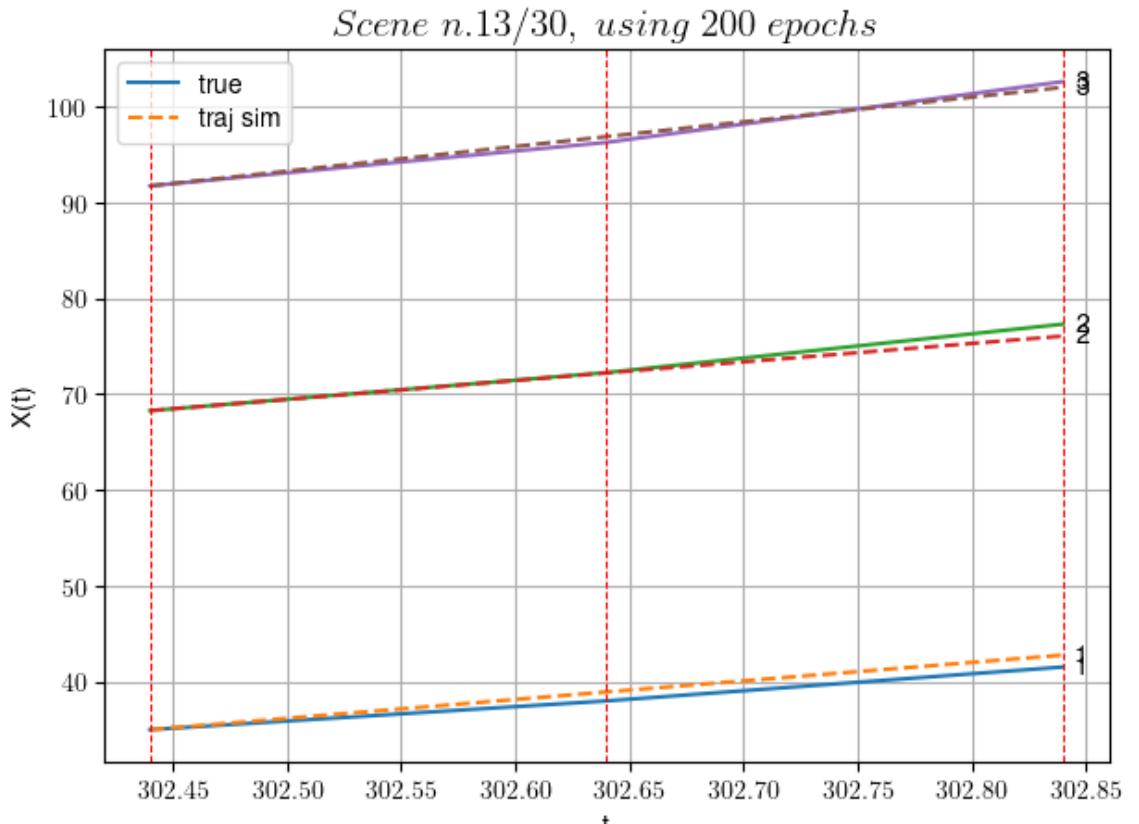
---

---

Scene n.13/30, time interval:[302.44,302.84]

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---



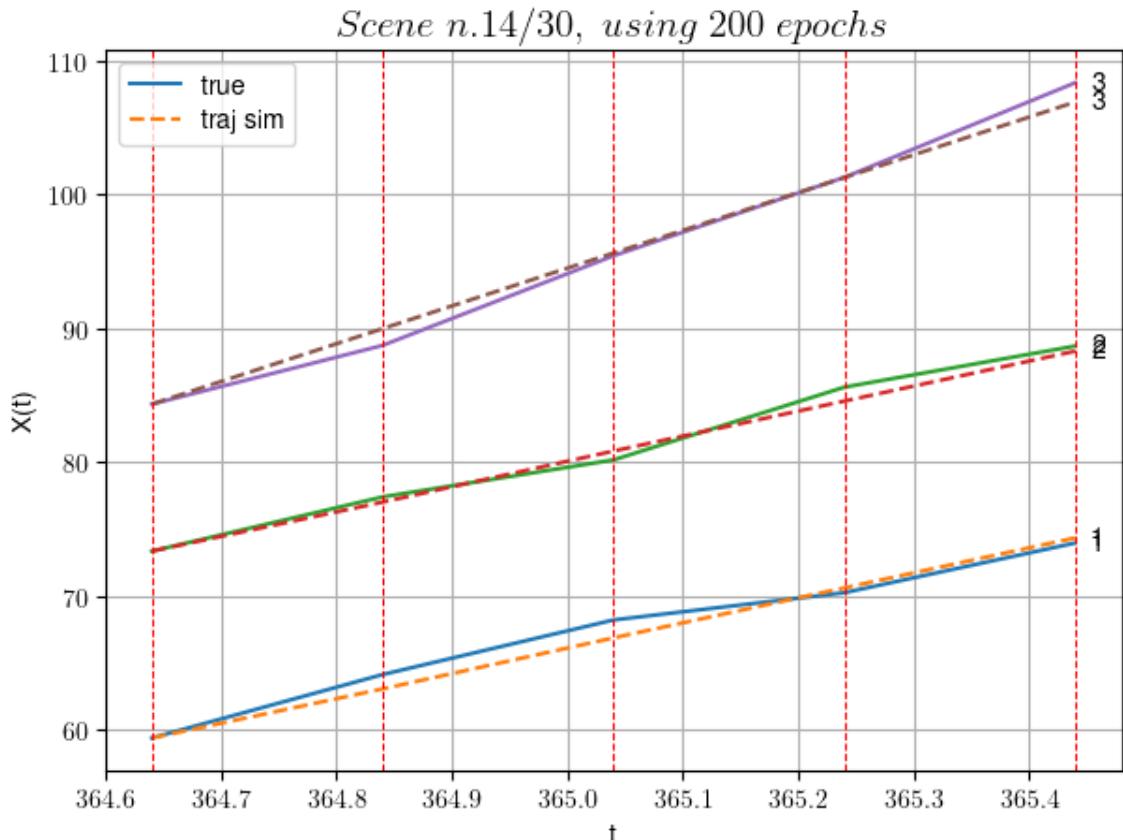
Loss: 0.5251942368077404

v0 updated: 25.749210786691933

---

Scene n.14/30, time interval:[364.64,365.44]

---



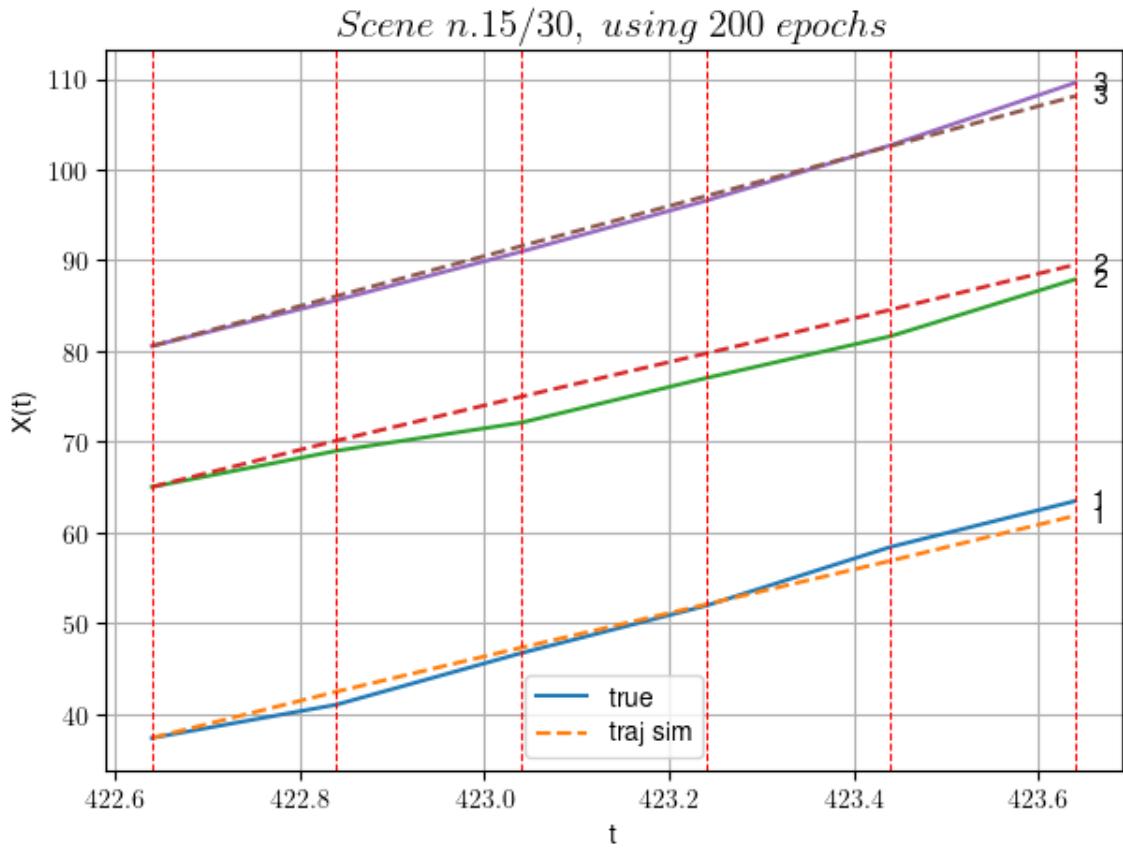
Loss: 0.5800360383648852  
v0 updated: 28.20769503184908

---

---

Scene n.15/30, time interval:[422.64,423.64]

---



Loss: 2.1312441956594683  
v0 updated: 27.54778513206394

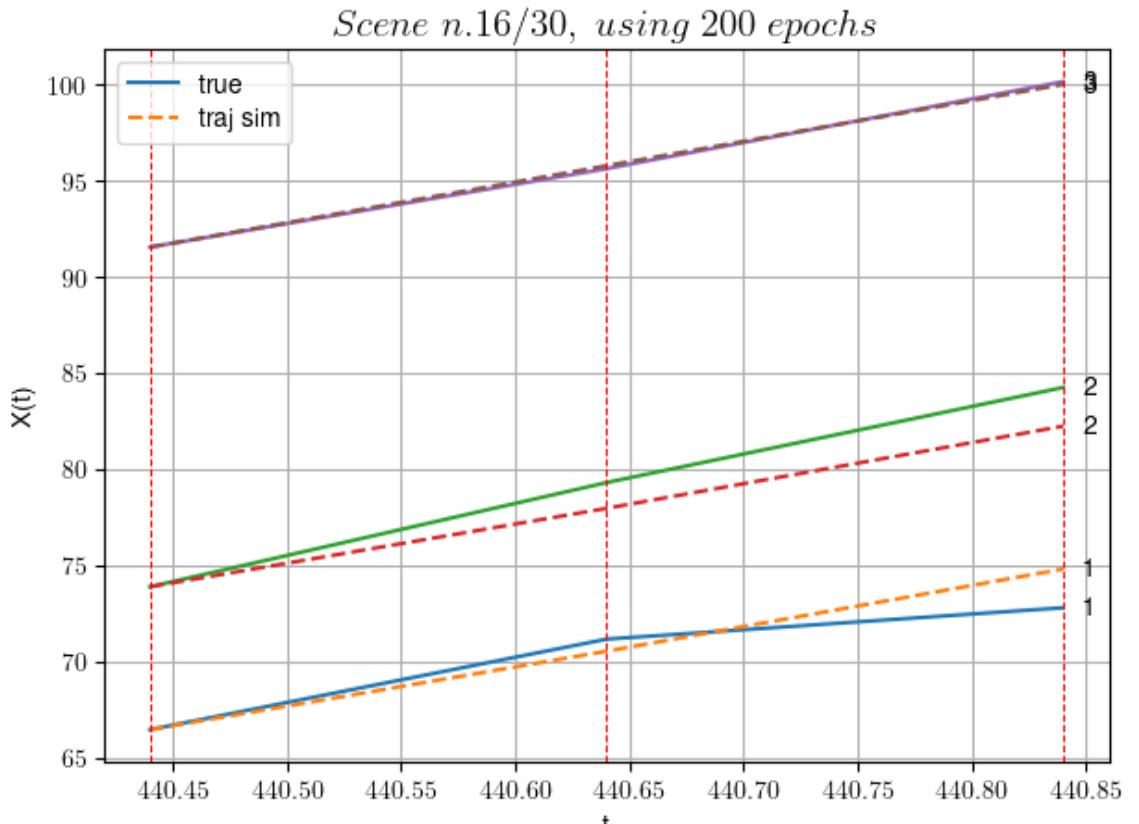
---

---

Scene n.16/30, time interval:[440.44,440.84]

---

---



Loss: 1.146009294757162  
v0 updated: 21.13673717572745

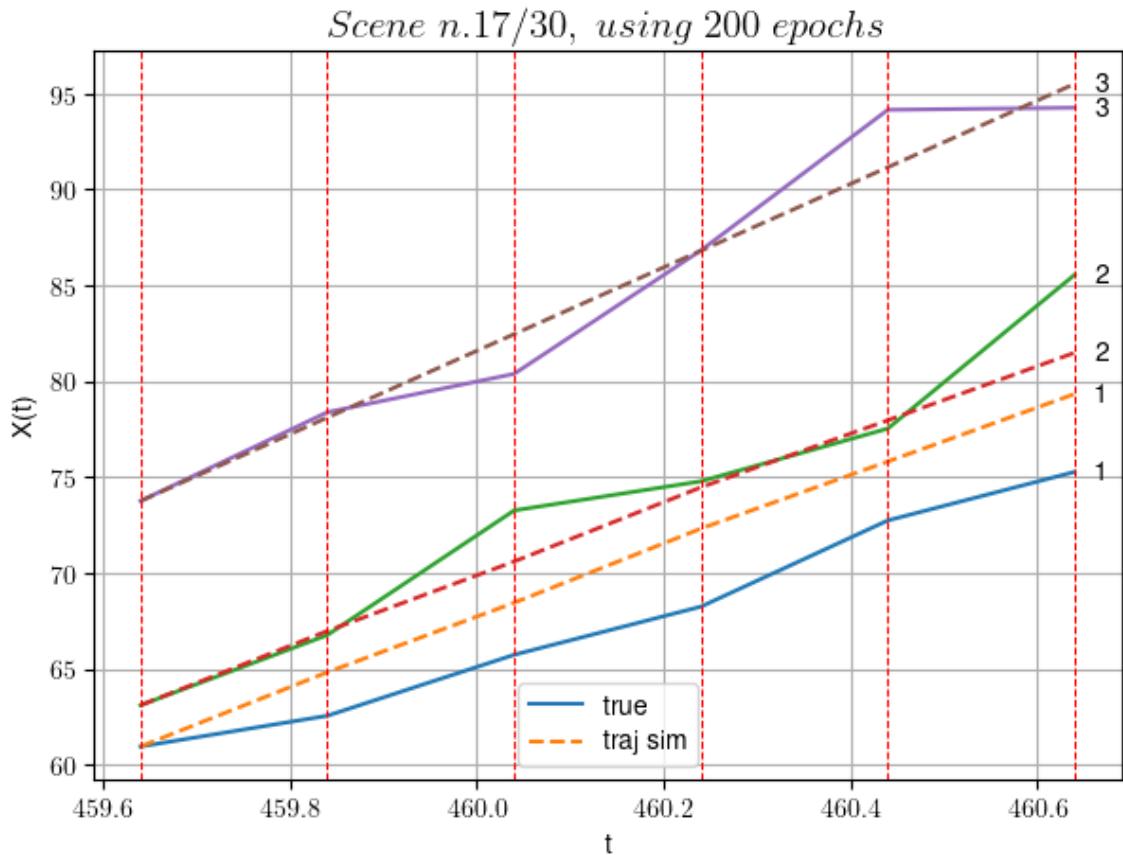
---

---

Scene n.17/30, time interval:[459.64,460.64]

---

---



Loss: 5.216621353856582  
v0 updated: 21.758536788642303

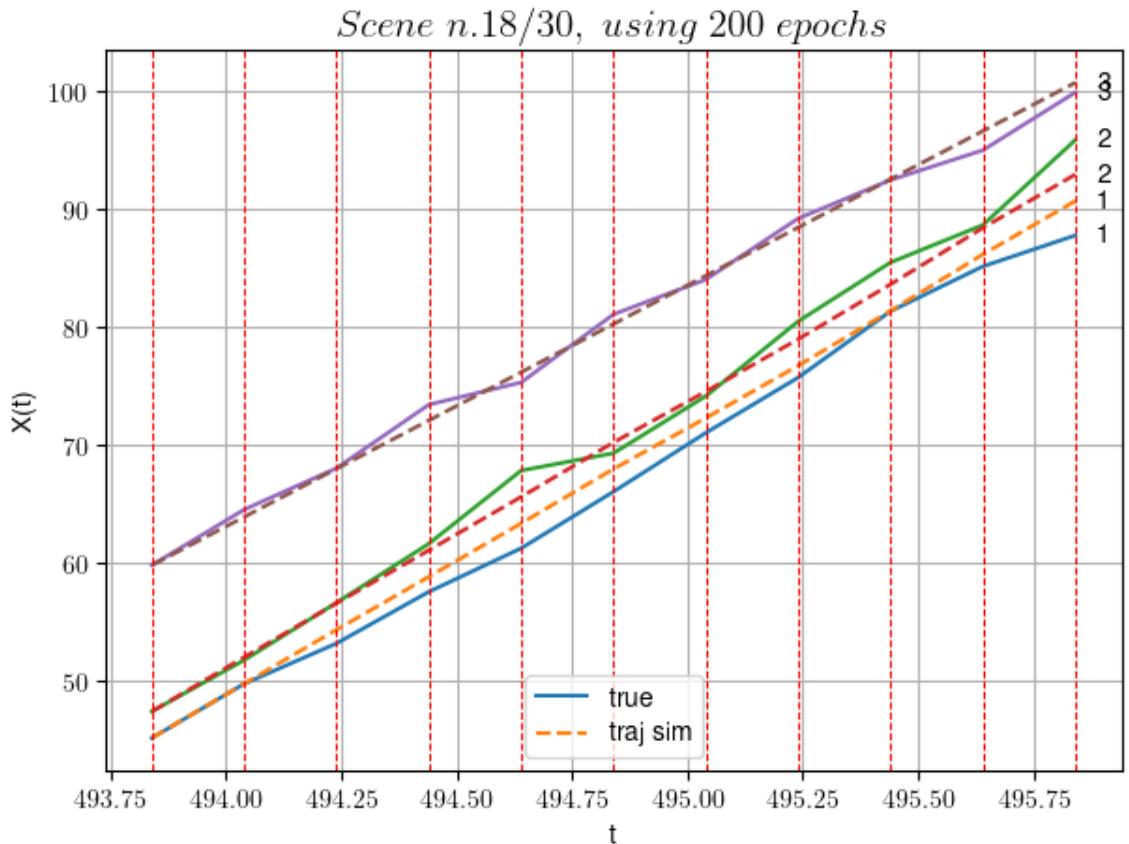
---

---

Scene n.18/30, time interval:[493.84,495.84]

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---



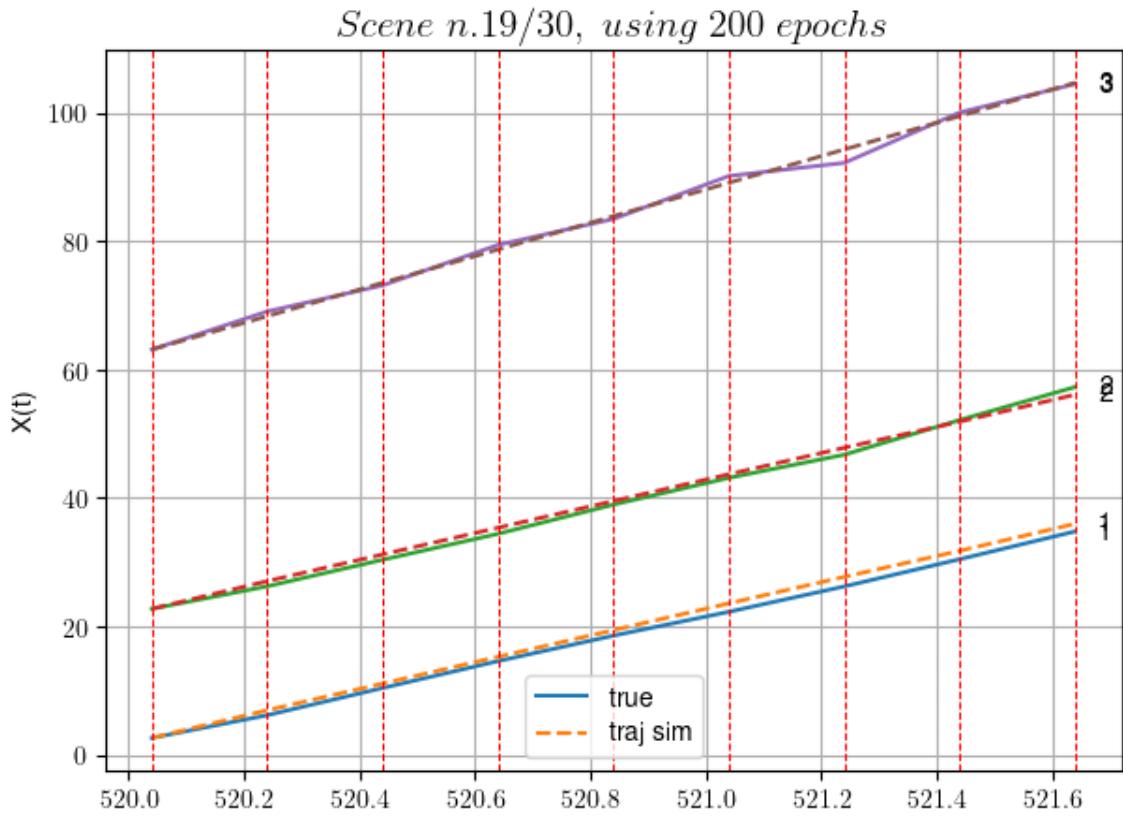
Loss: 1.5616017930101886  
v0 updated: 20.44744200453107

---

---

Scene n.19/30, time interval:[520.04,521.64]

---



Loss: 0.819243485095873  
v0 updated: 25.967240218471442

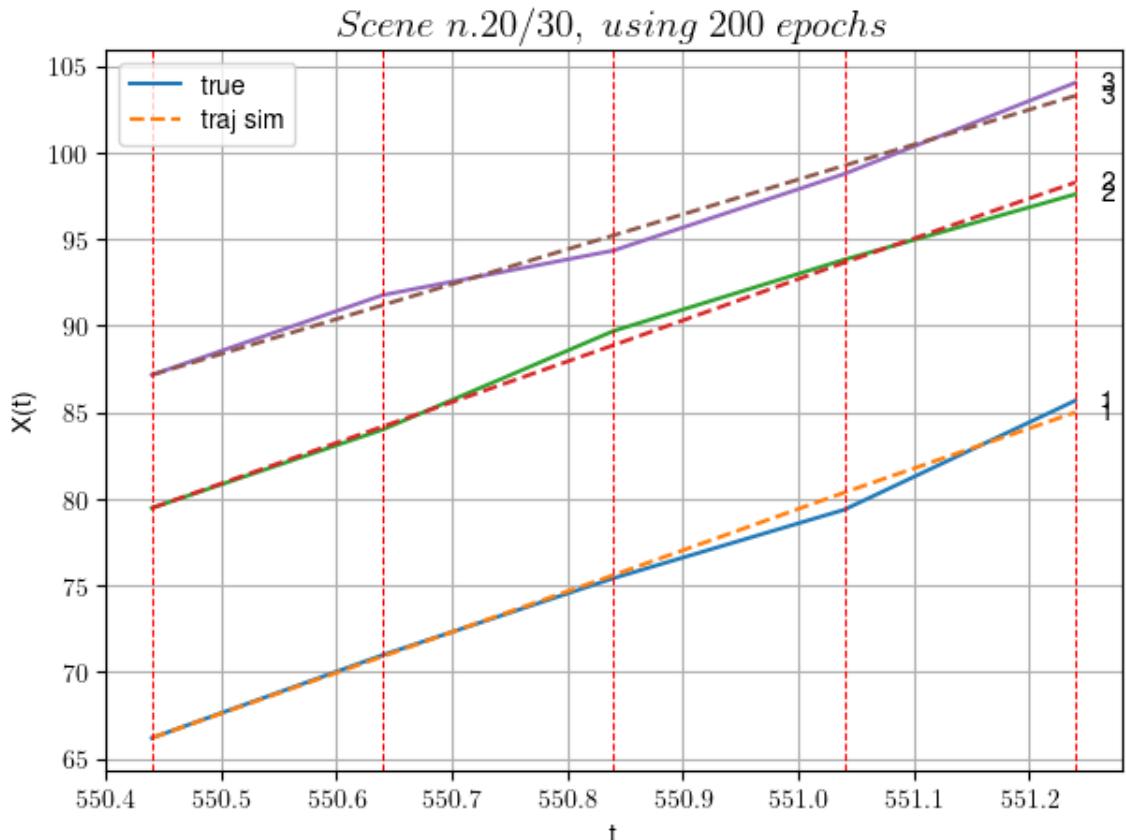
---

---

Scene n.20/30, time interval:[550.44,551.24]

---

---



Loss: 0.3059578033379852  
v0 updated: 20.15921482706291

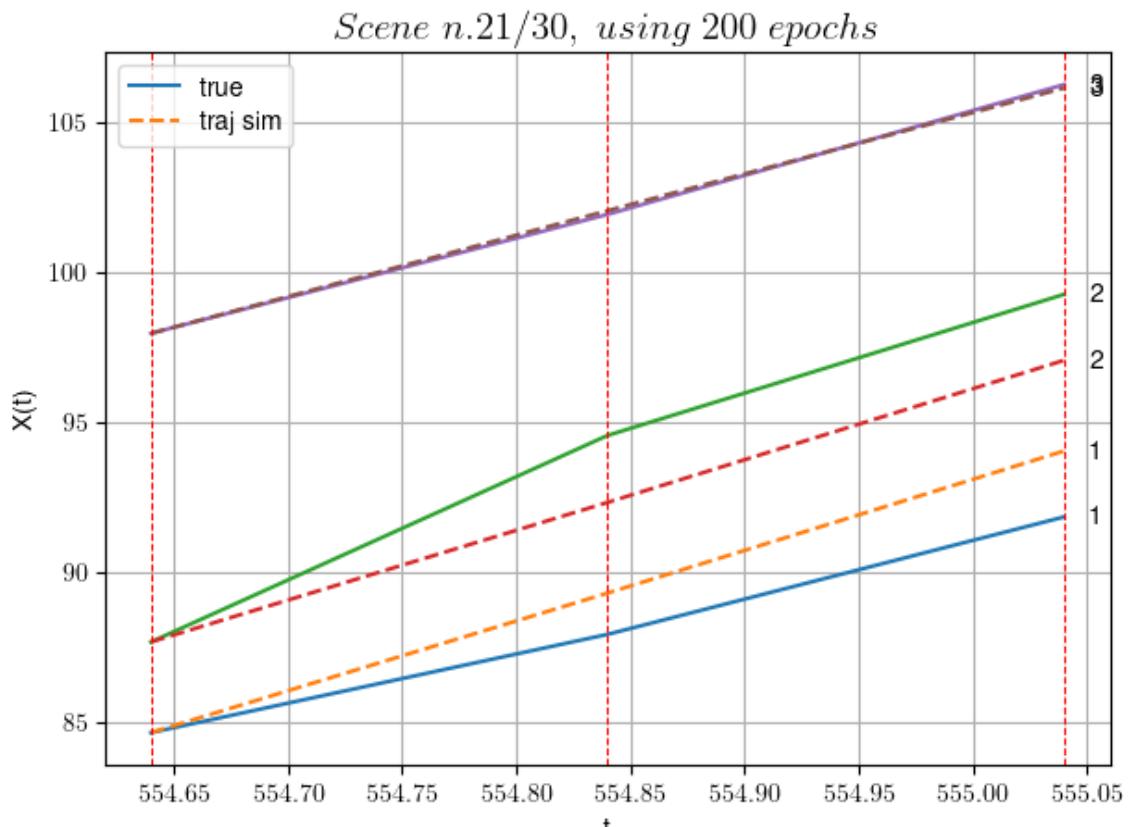
---

---

Scene n.21/30, time interval:[554.64,555.04]

---

---



Loss: 1.8427679422850811  
v0 updated: 20.45122402685835

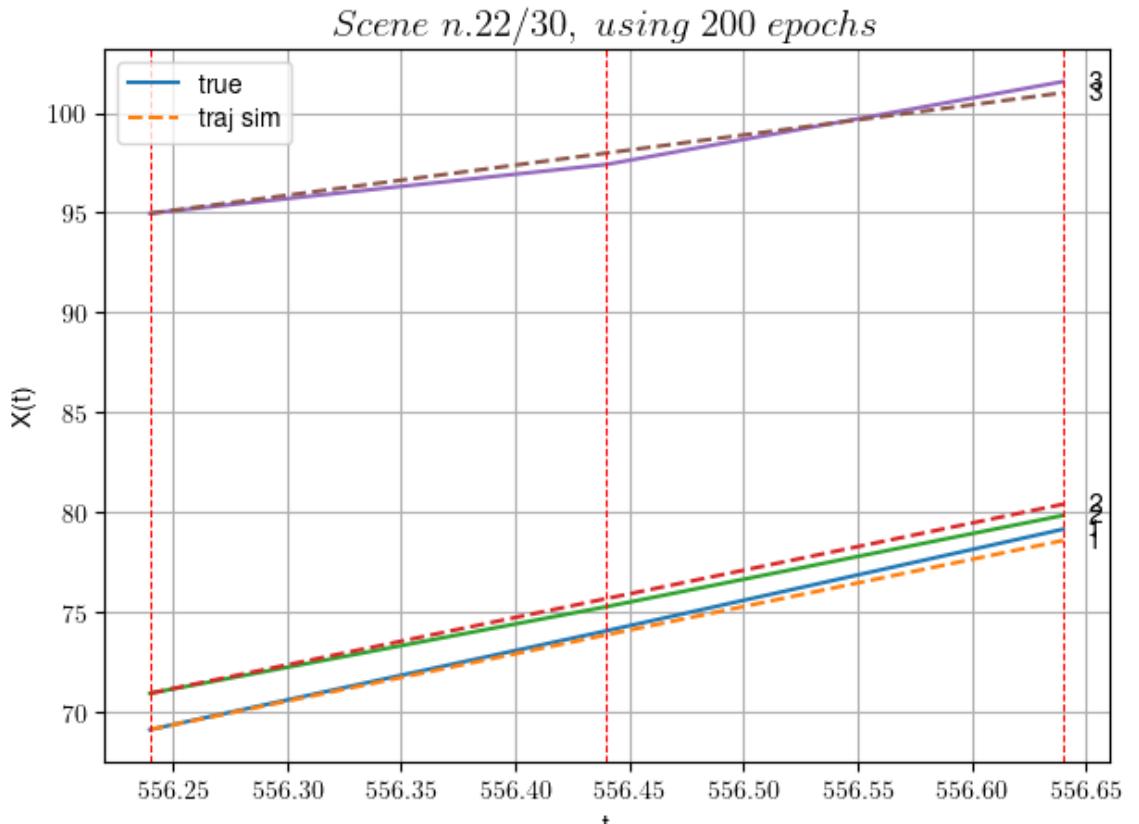
---

---

Scene n.22/30, time interval:[556.24,556.64]

---

---



Loss: 0.16466453193991418  
v0 updated: 15.10246810565707

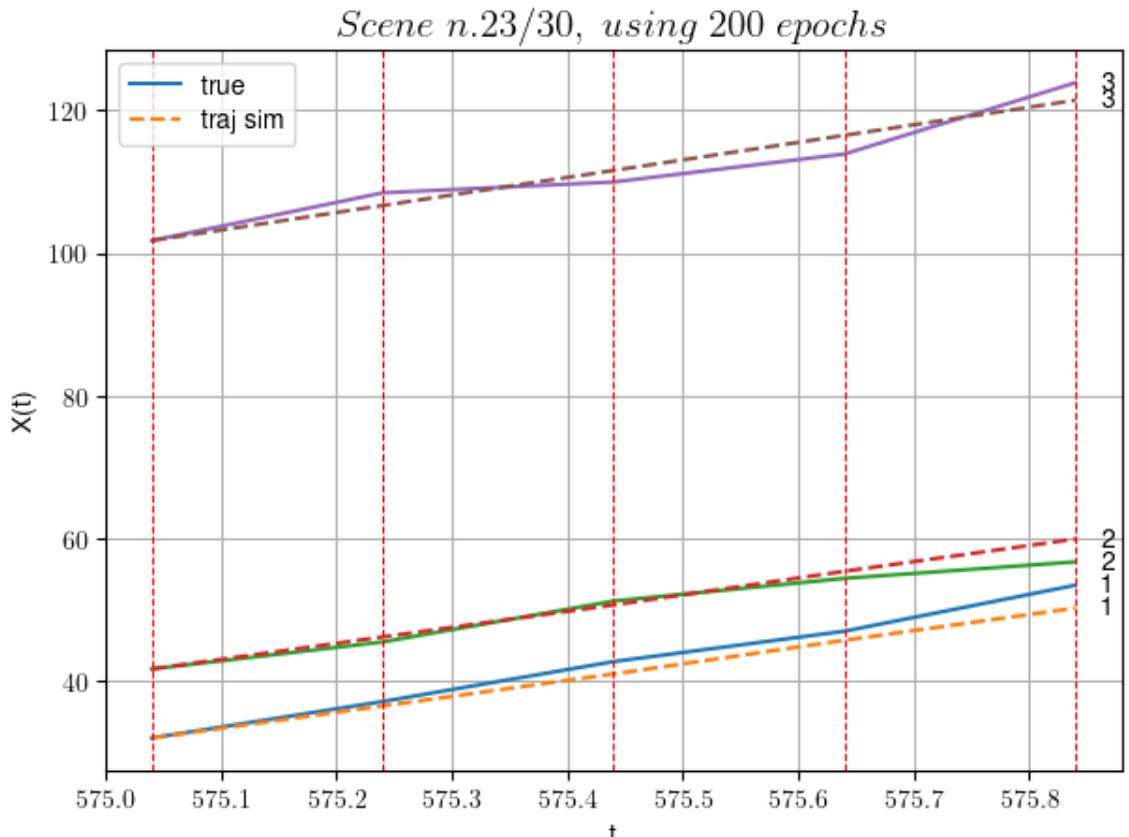
---

---

Scene n.23/30, time interval:[575.04,575.84]

---

---



Loss: 3.053602406779133  
v0 updated: 24.55161048759143

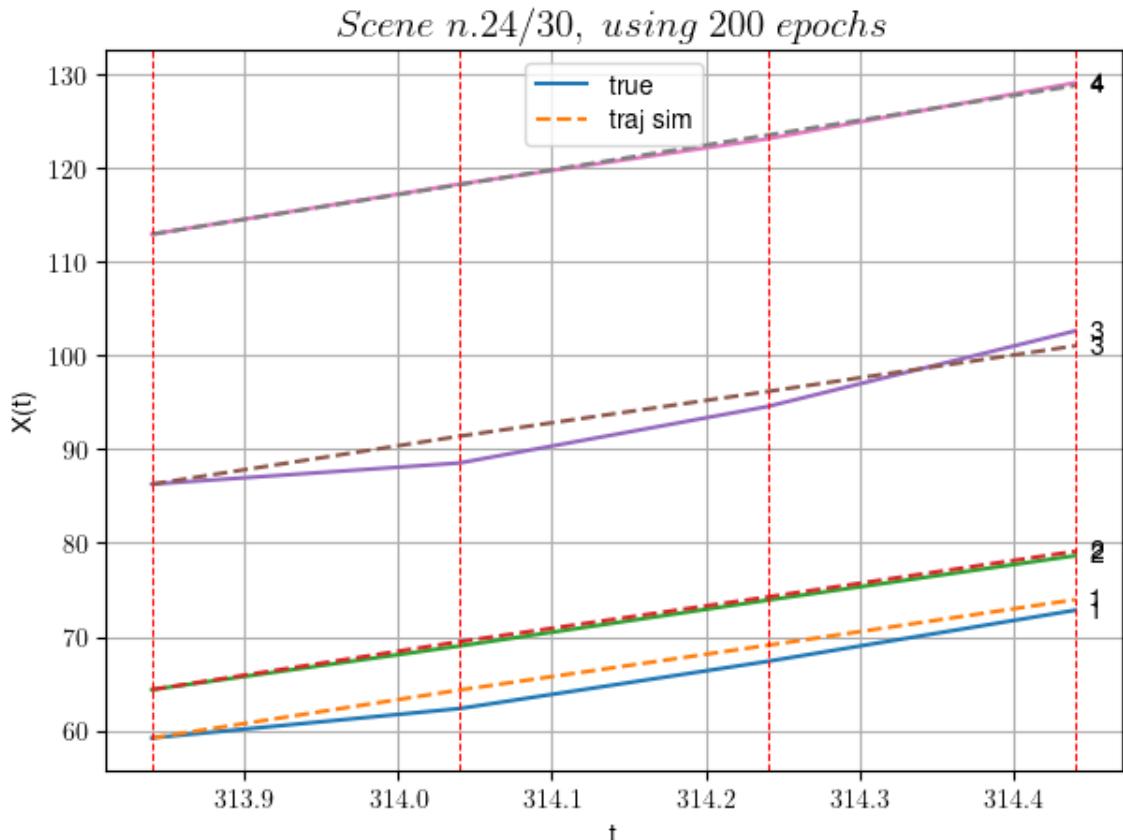
---

---

Scene n.24/30, time interval:[313.84,314.44]

---

---



Loss: 1.3878732062538388  
v0 updated: 26.437615898639695

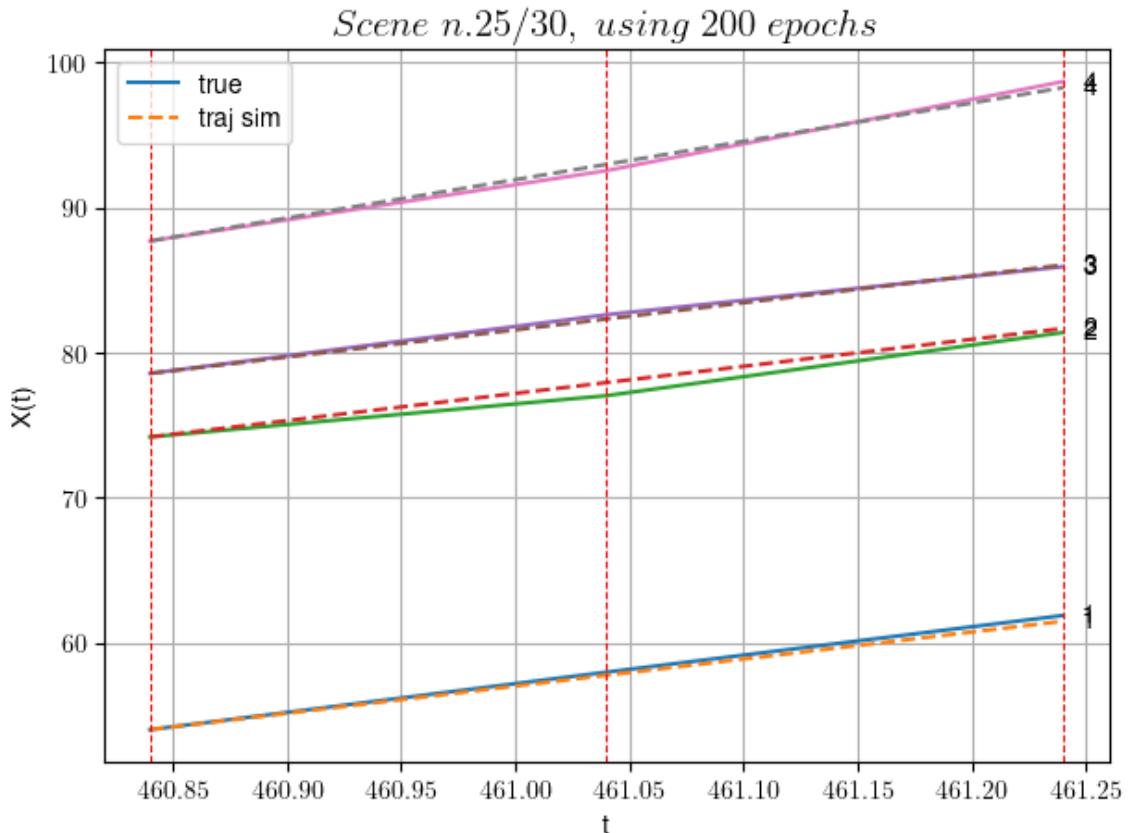
---

---

Scene n.25/30, time interval:[460.84,461.24]

---

---



Loss: 0.13042152016940237  
v0 updated: 26.426470006325165

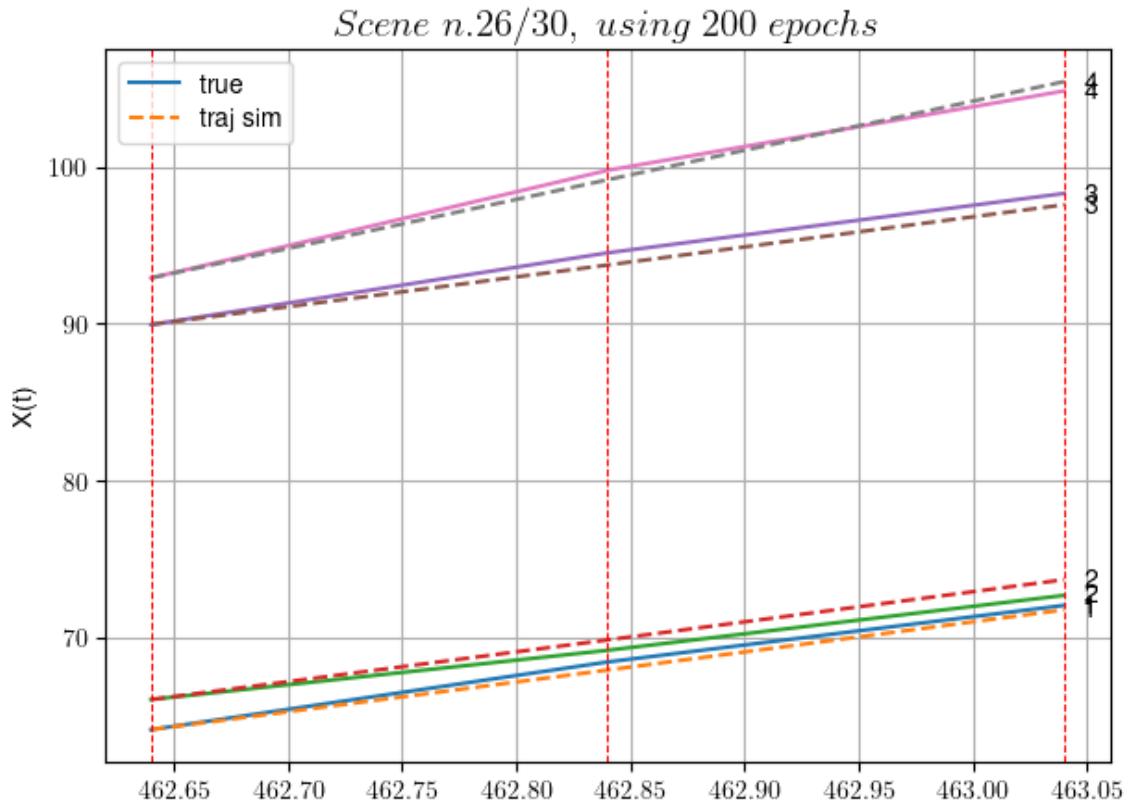
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---

Scene n.26/30, time interval:[462.64,463.04]

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---

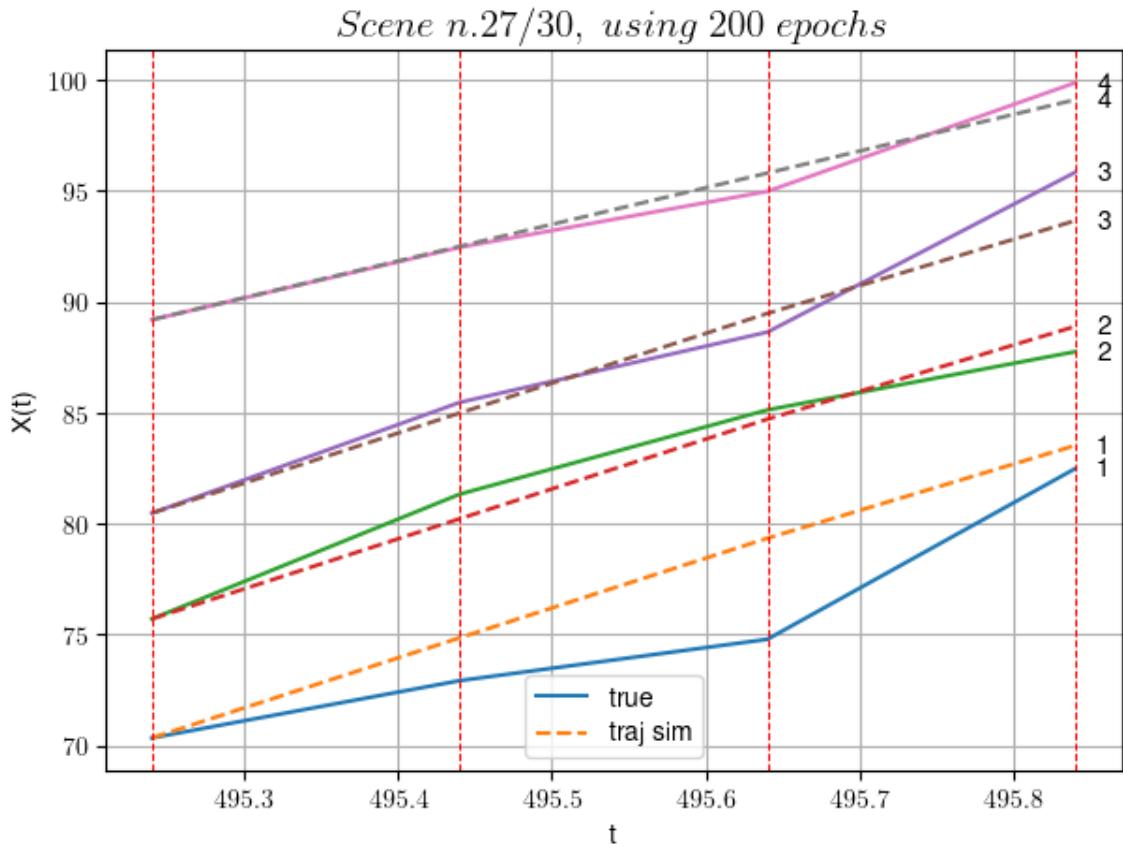


Loss: 0.3027131968145973  
v0 updated: 31.34411385355845

---

Scene n.27/30, time interval:[495.24,495.84]

---



Loss: 2.200974446666891  
v0 updated: 16.521371437174743

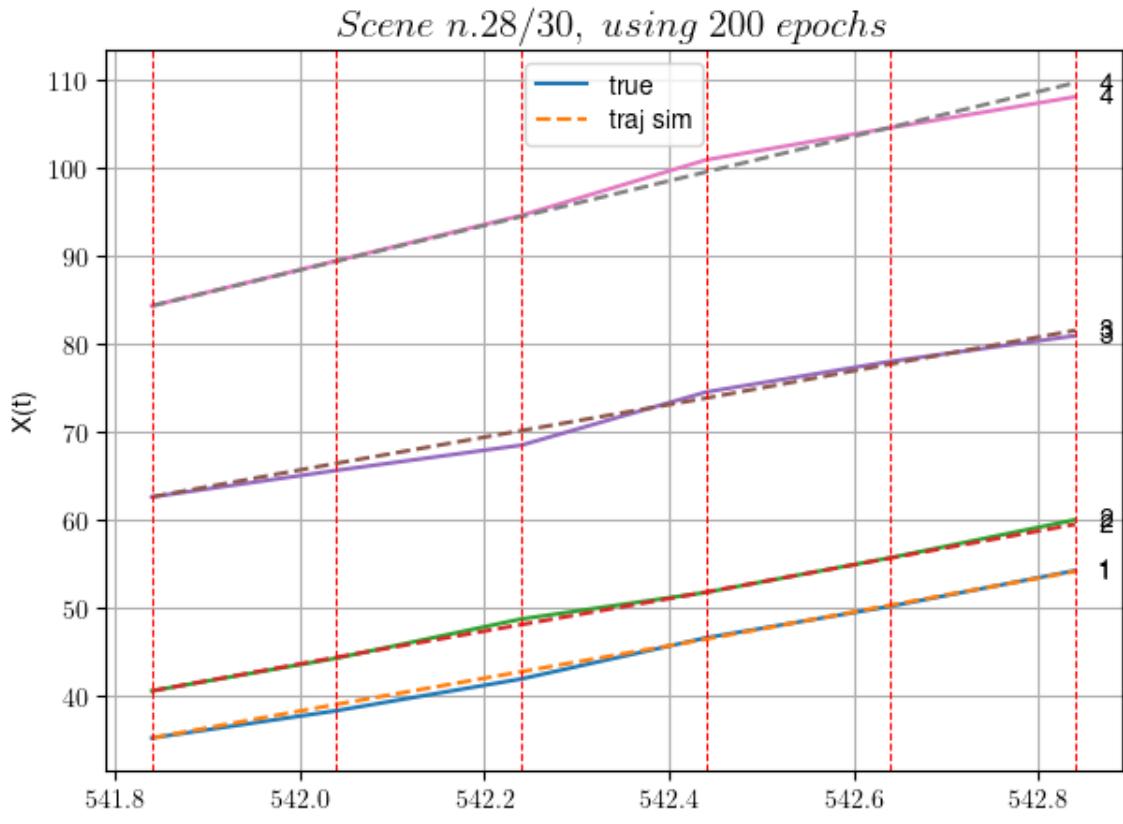
---

---

Scene n.28/30, time interval:[541.84,542.84]

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---



Loss: 0.44570741071986864  
v0 updated: 25.34048009127371

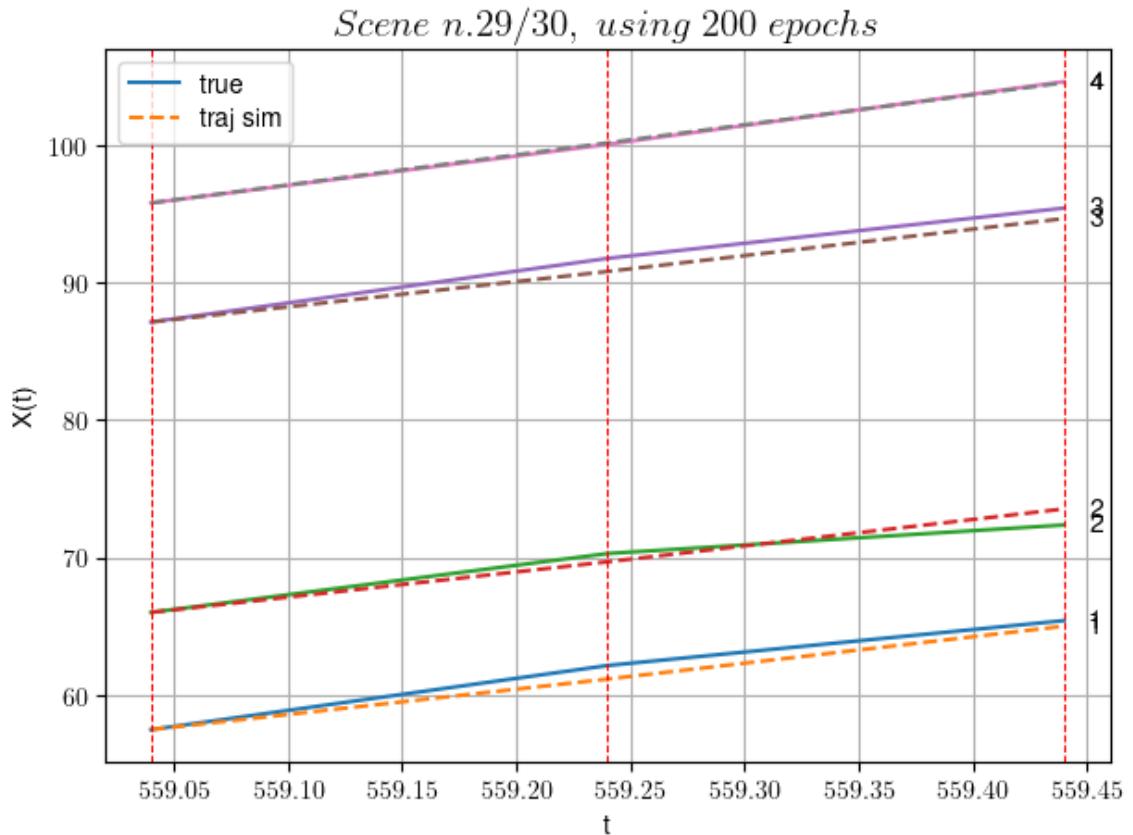
---

---

Scene n.29/30, time interval:[559.04,559.44]

---

---



Loss: 0.36481085034621313  
 v0 updated: 21.871231487187927

---



---

v0\_mean in this df is: 24.678648054029146  
 Time taken: 194.25s  
 Hidden-Layer-1/kernel:0: [-1.0314503e+01 -7.5116525e+00 -1.  
 2637139e+05 -6.0159552e+02]  
 Hidden-Layer-1/bias:0: [ -9.177155 -7.33252 -6253.4644 -  
 341.692 ]  
 Output-Layer/kernel:0: [-1.7941561e+00 4.7476025e+00 -1.5931100  
 e+05 1.4249943e+01]  
 Output-Layer/bias:0: [18.39388]

---



---

In df n.5/10 we have 14 scenes

---



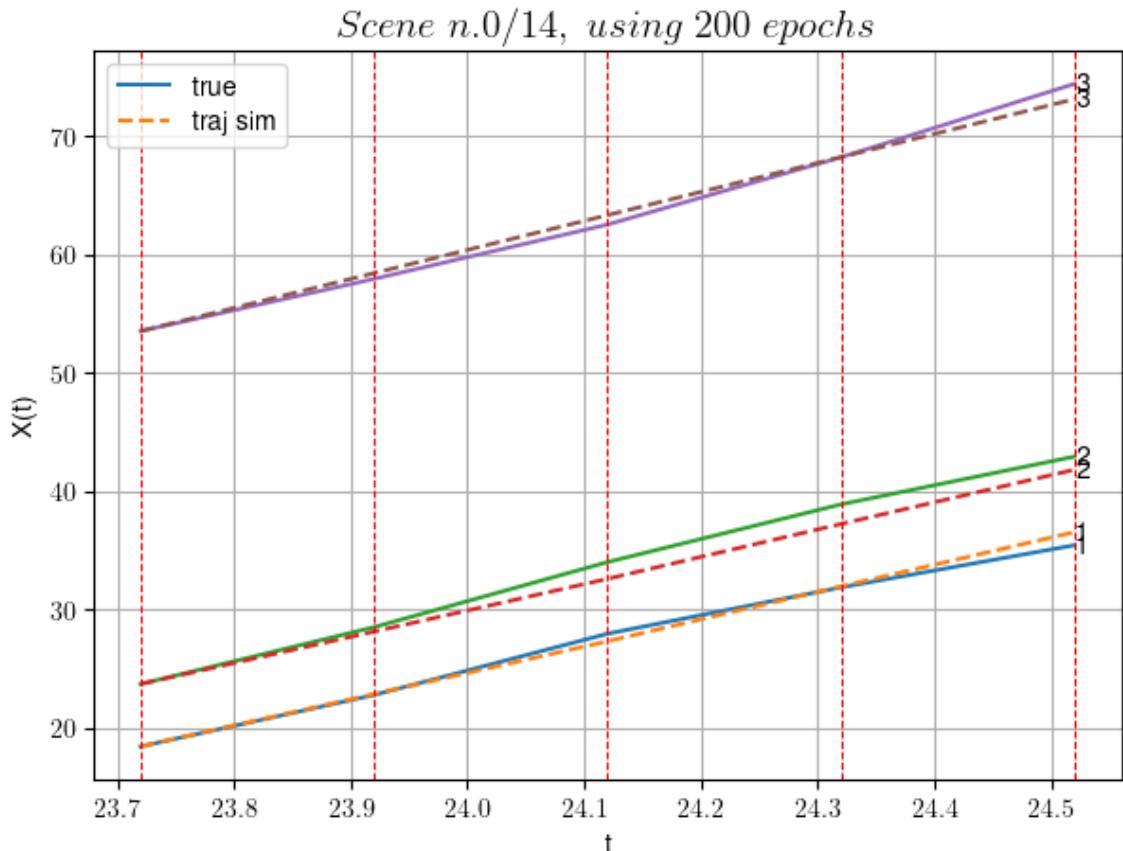
---

Scene n.0/14, time interval:[23.72,24.52]

---



---



Loss: 0.6879698711538809  
v0 updated: 24.540804592766374

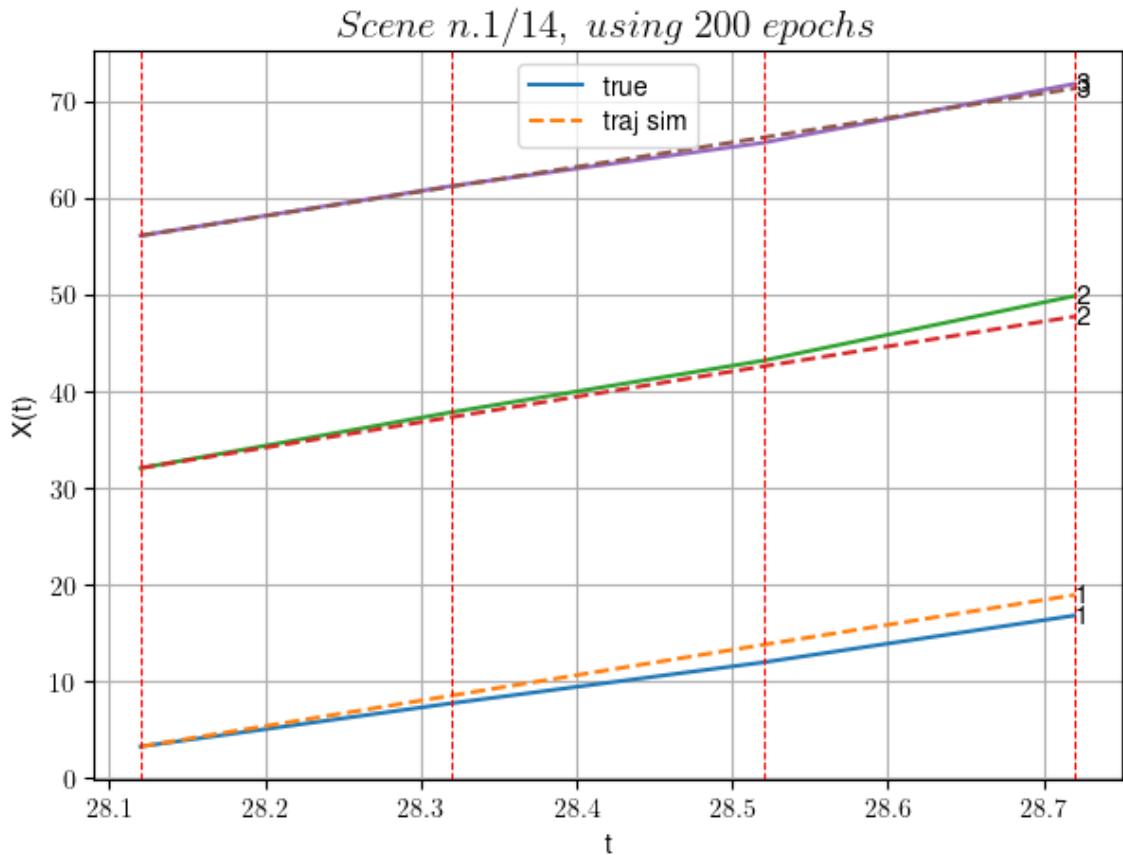
---

---

Scene n.1/14, time interval:[28.12,28.72]

---

---



Loss: 1.180089782740242  
v0 updated: 25.38445729058461

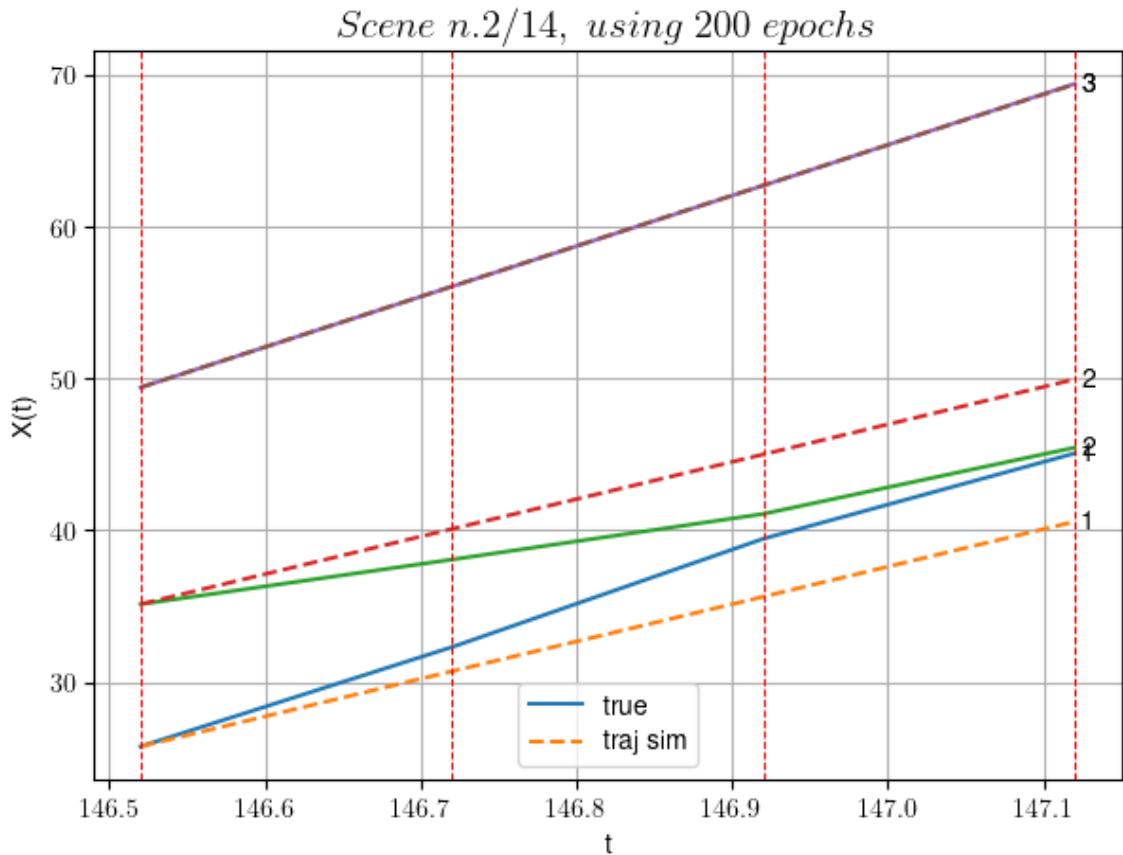
---

---

Scene n.2/14, time interval:[146.52,147.12]

---

---



Loss: 6.399567259373039  
v0 updated: 33.24361982546581

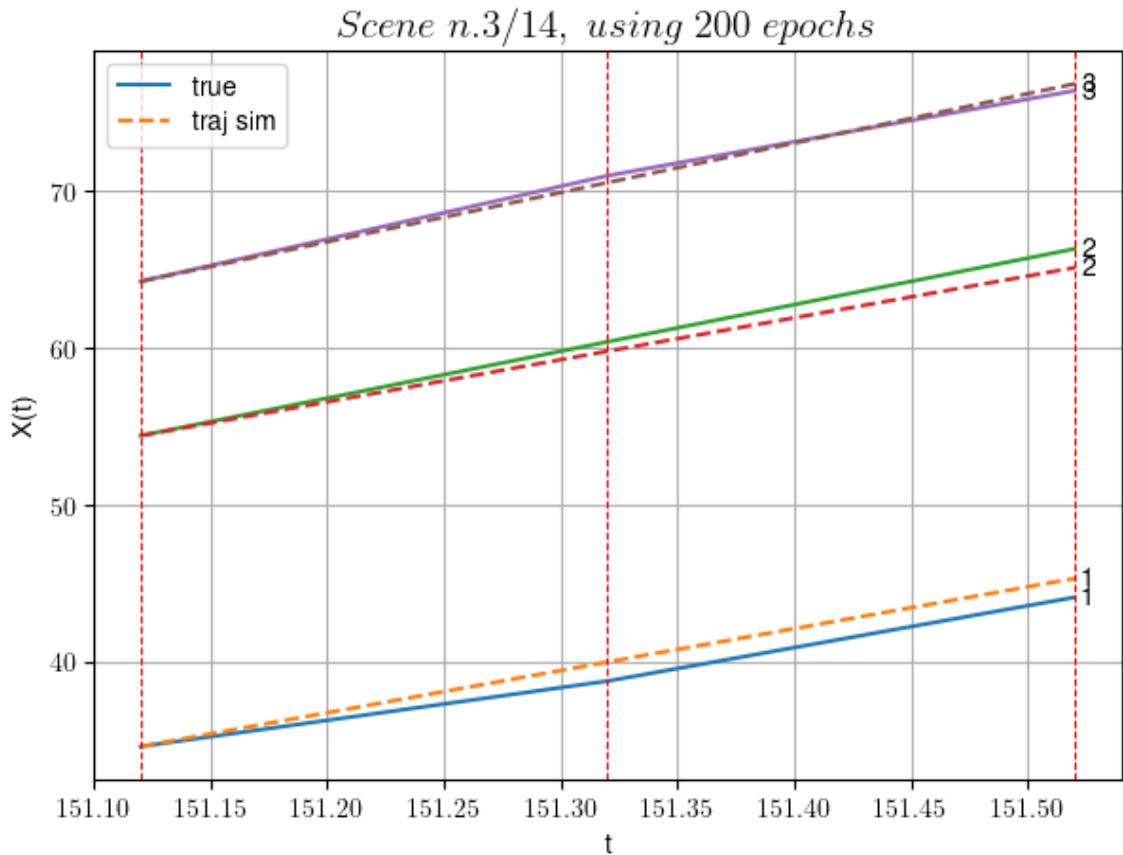
---

---

Scene n.3/14, time interval:[151.12,151.52]

---

---



Loss: 0.5682709199537672  
v0 updated: 31.514473997442256

---

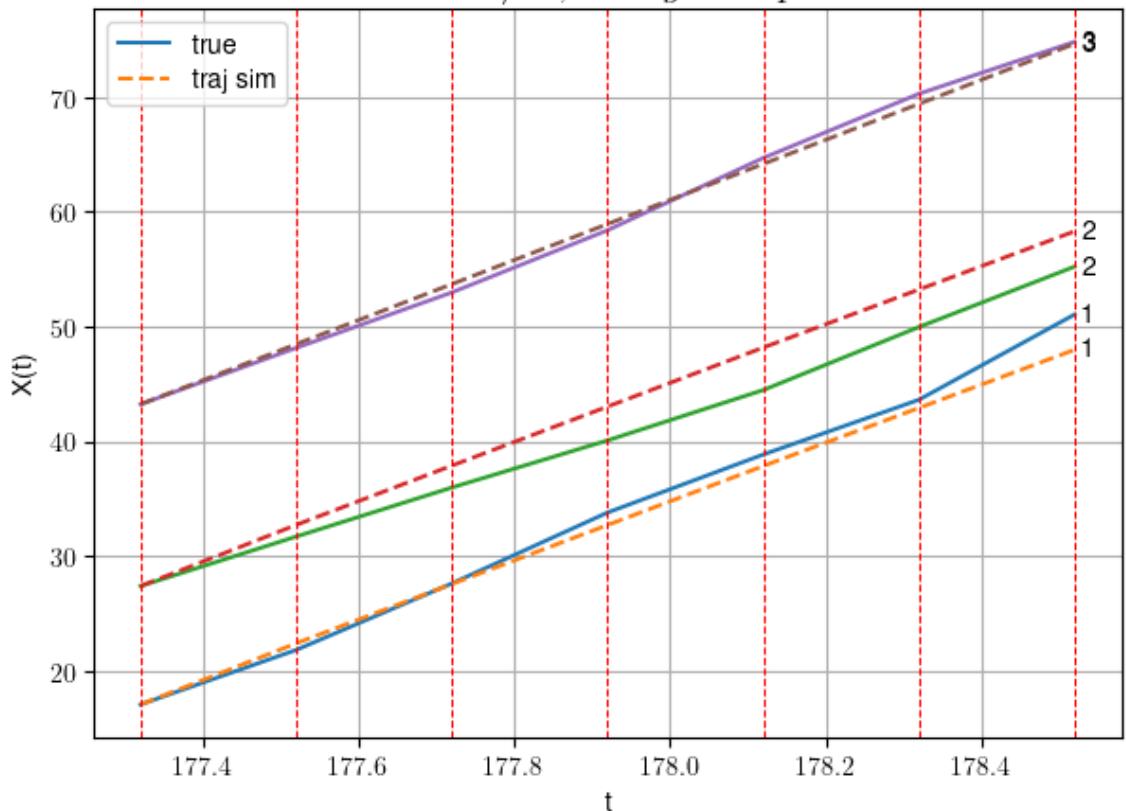
---

Scene n.4/14, time interval:[177.32,178.52]

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---

Scene n.4/14, using 200 epochs

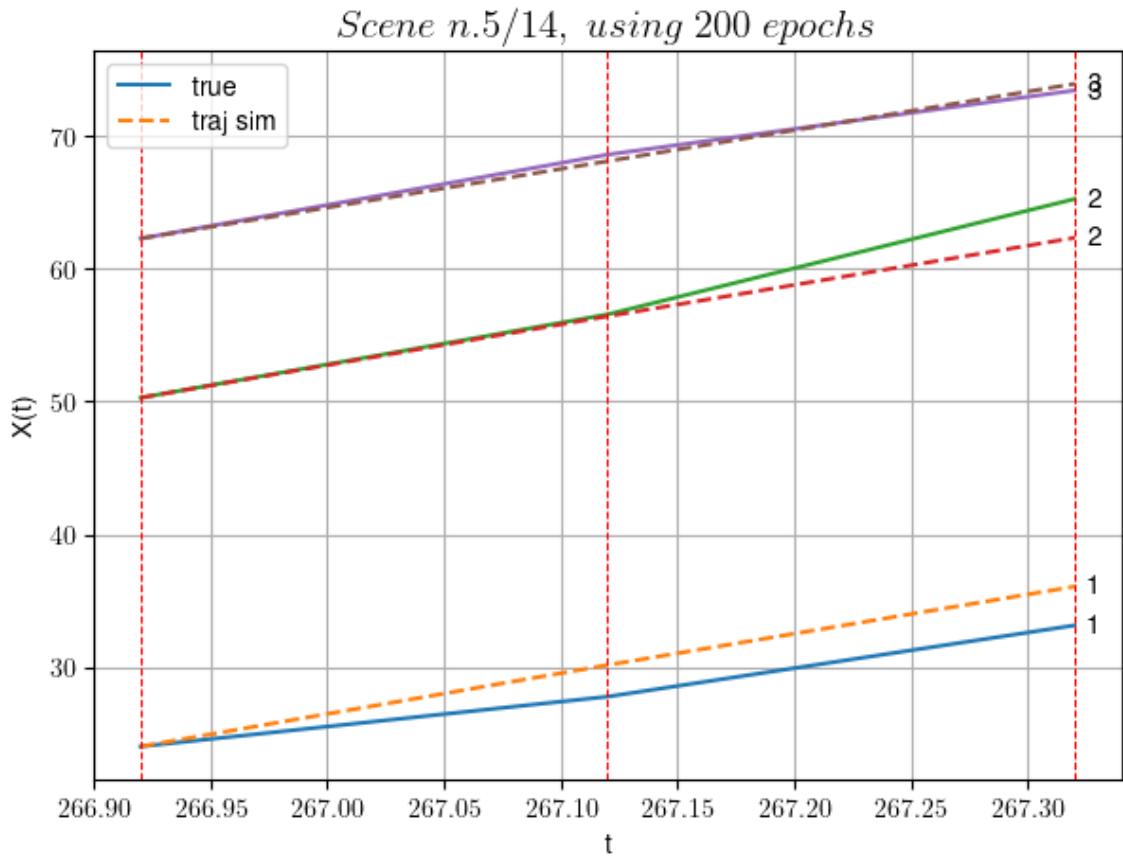


Loss: 2.9389605605339555  
v0 updated: 26.18457238016555

---

Scene n.5/14, time interval:[266.92,267.32]

---



Loss: 2.577861980685881  
v0 updated: 29.08670553770542

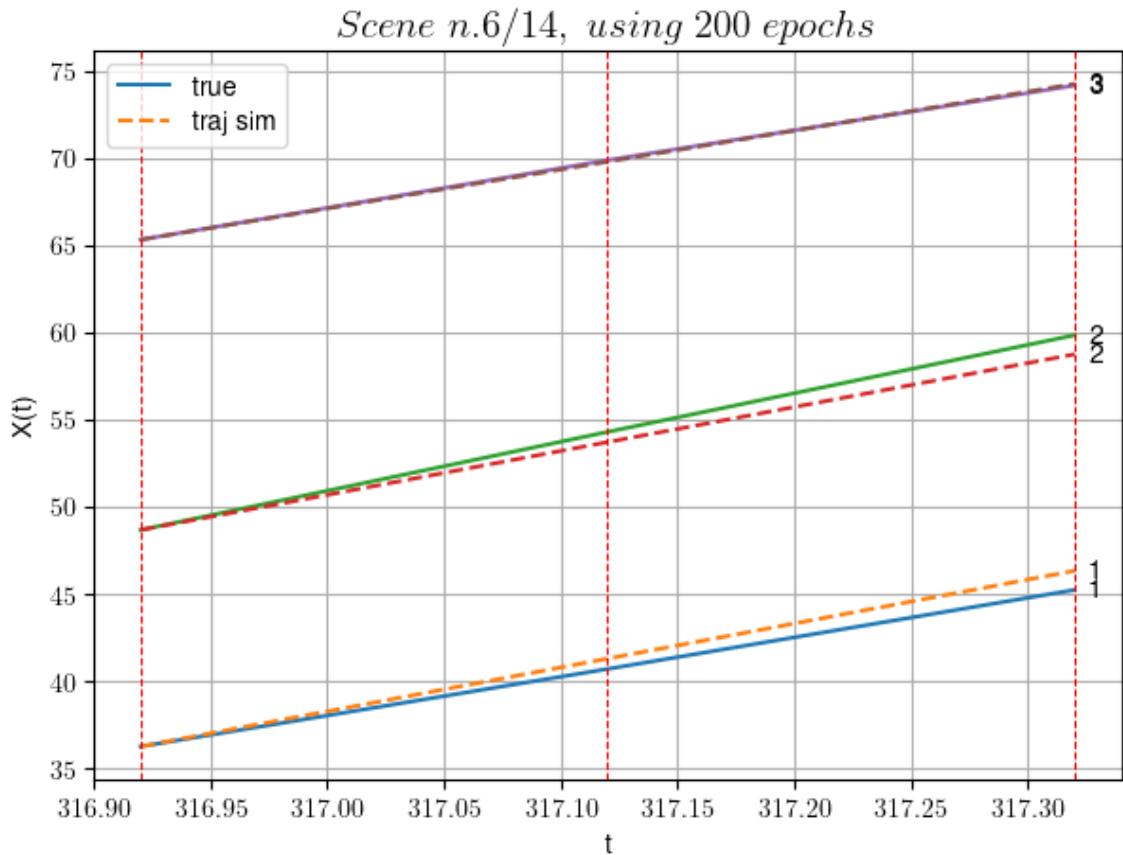
---

---

Scene n.6/14, time interval:[316.92,317.32]

---

---



Loss: 0.34613677476566224  
v0 updated: 22.350454396791342

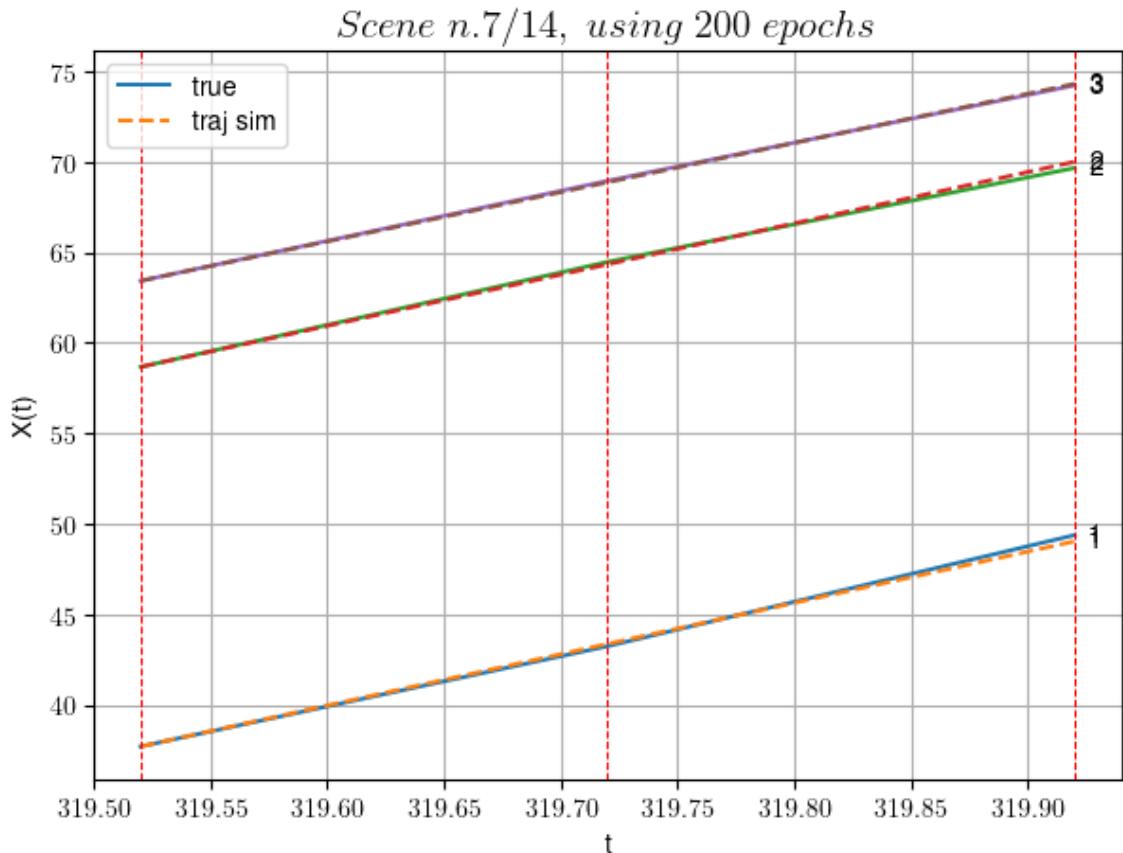
---

---

Scene n.7/14, time interval:[319.52,319.92]

---

---



Loss: 0.03174788545450367  
v0 updated: 27.22550971636396

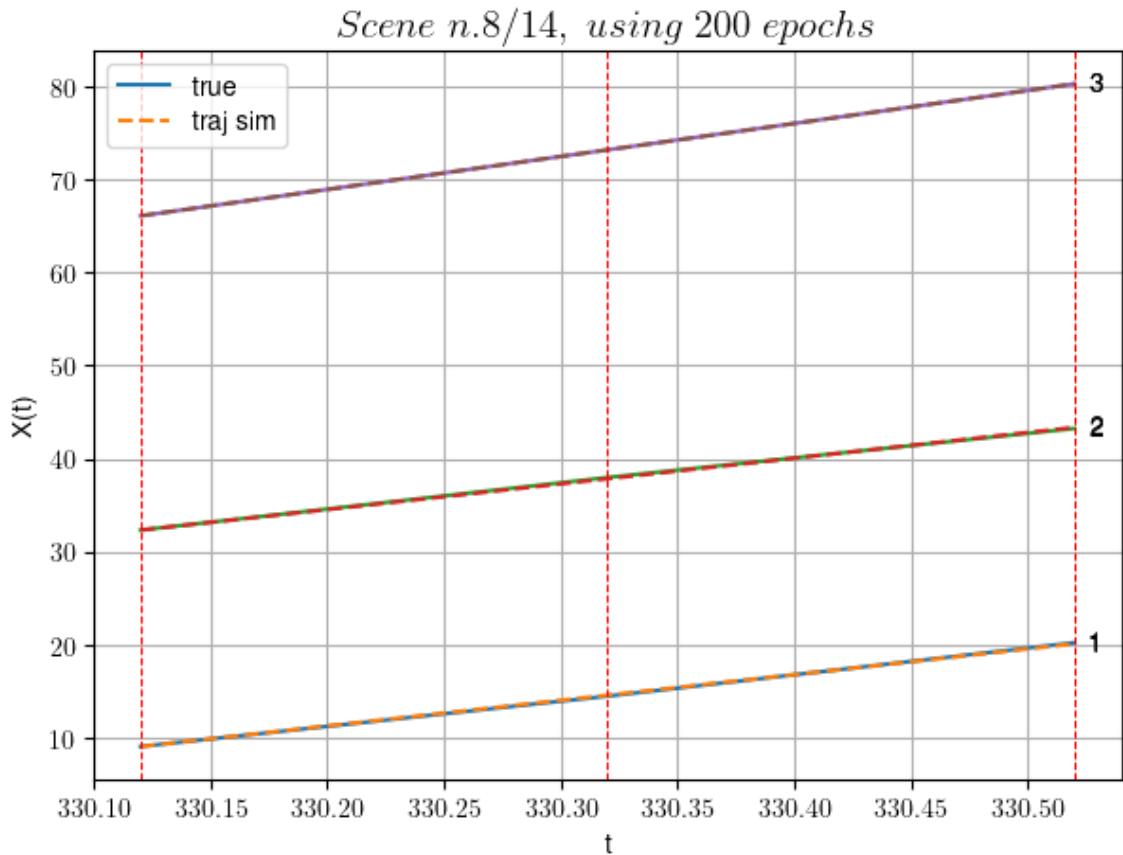
---

---

Scene n.8/14, time interval:[330.12,330.52]

---

---



Loss: 0.006576960175479862  
v0 updated: 35.47266760034579

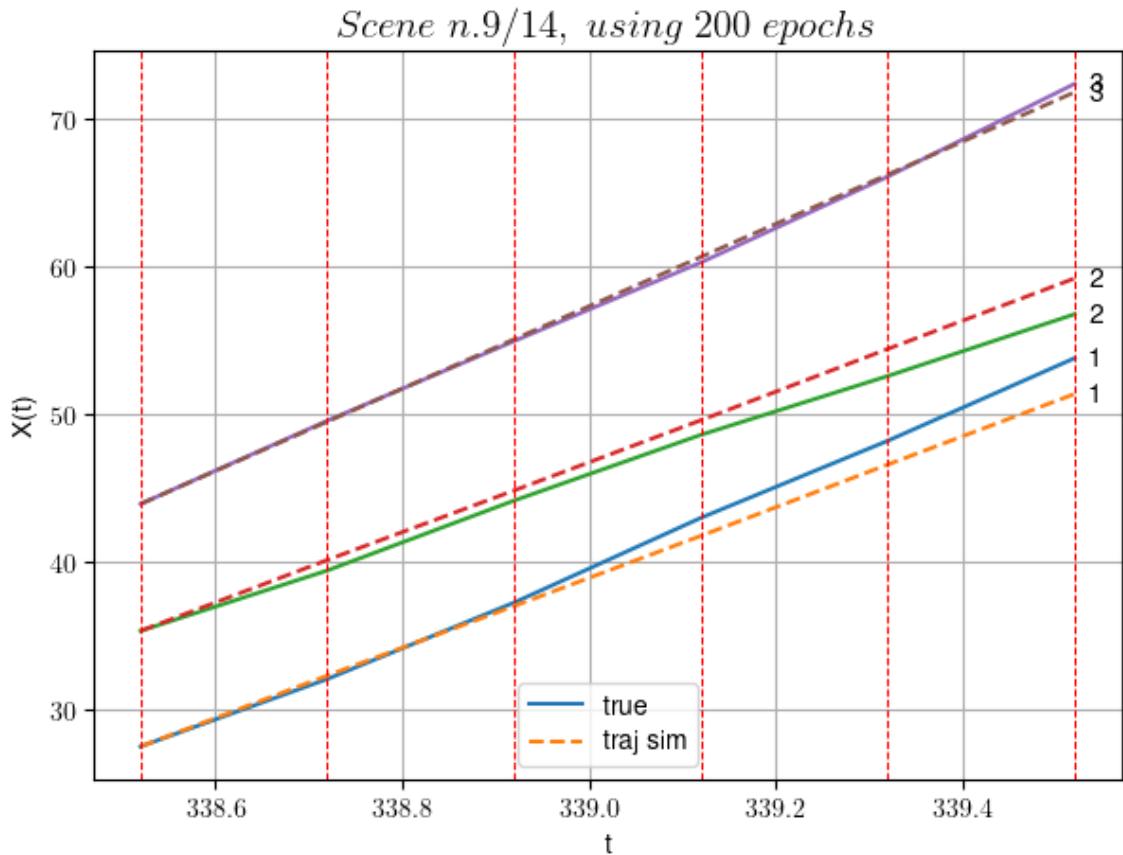
---

---

Scene n.9/14, time interval:[338.52,339.52]

---

---



Loss: 1.206951571967755  
v0 updated: 27.856284841251647

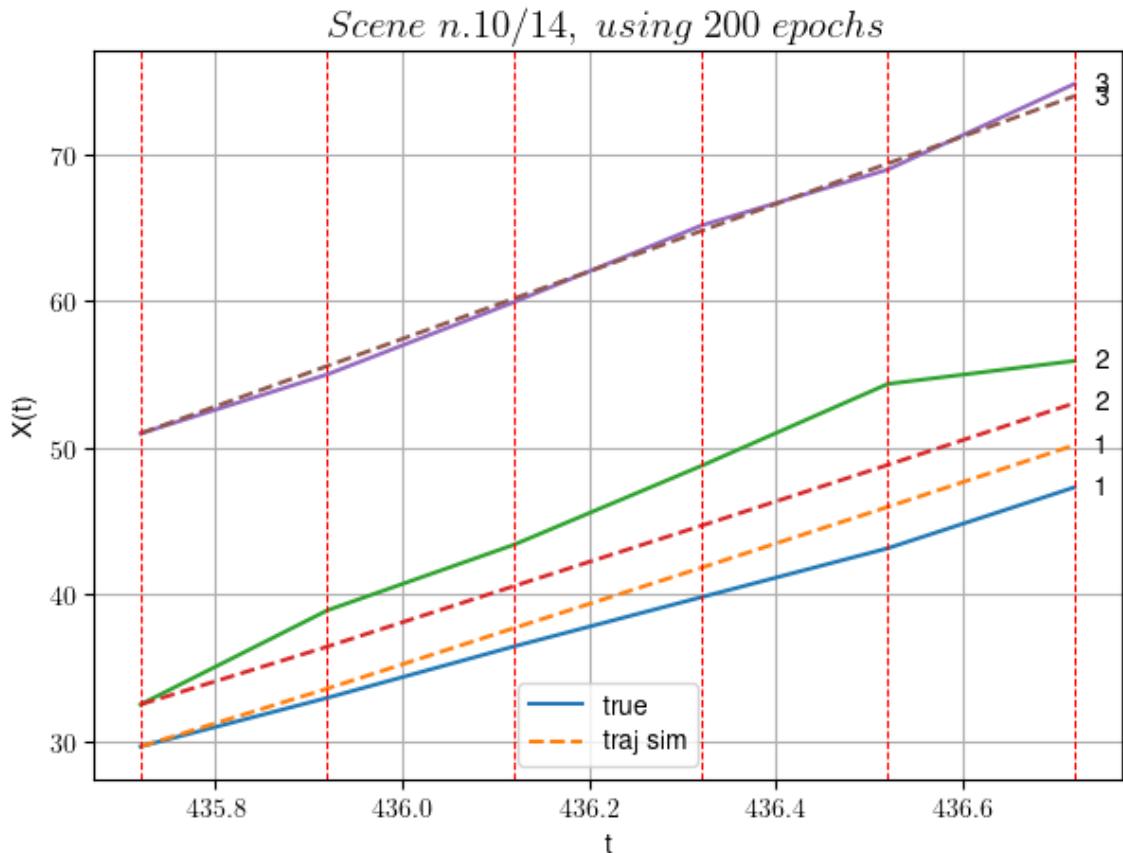
---

---

Scene n.10/14, time interval:[435.72,436.72]

---

---



Loss: 5.169256646940307  
v0 updated: 23.00995307931417

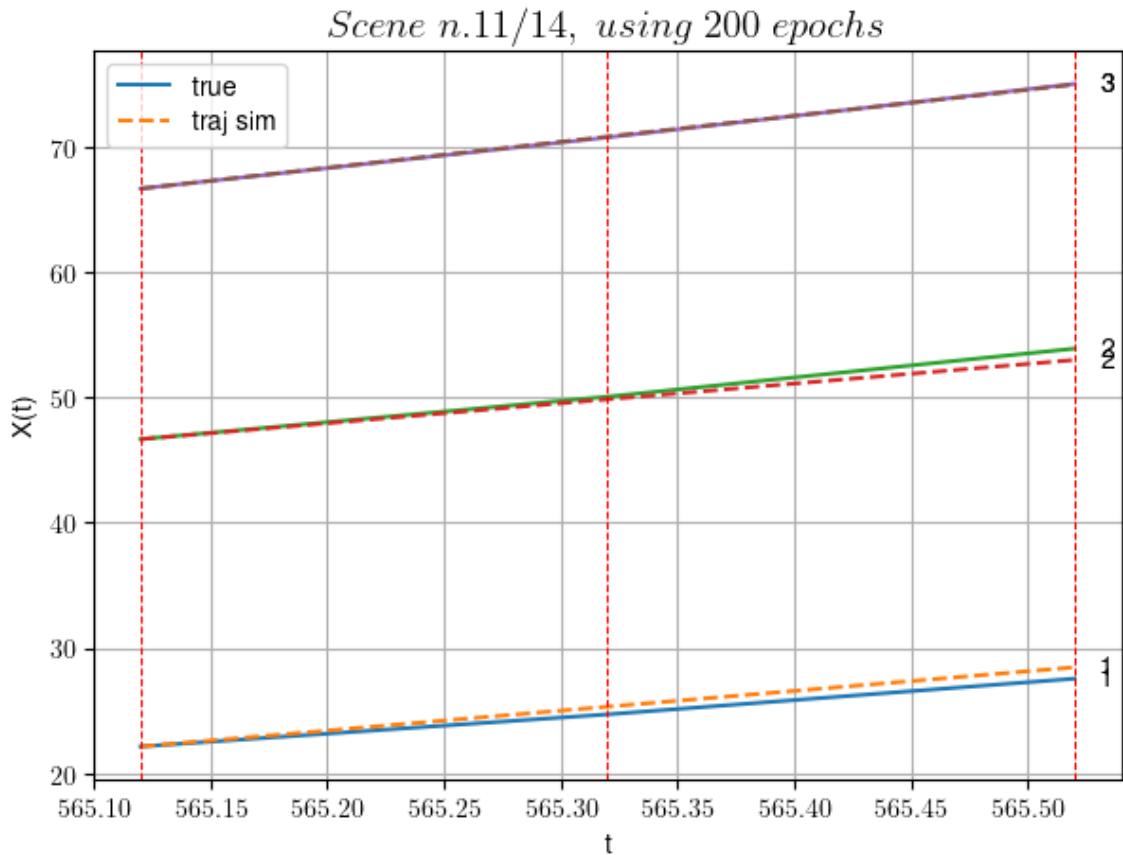
---

---

Scene n.11/14, time interval:[565.12,565.52]

---

---



Loss: 0.23052335029690155  
v0 updated: 20.76046991302415

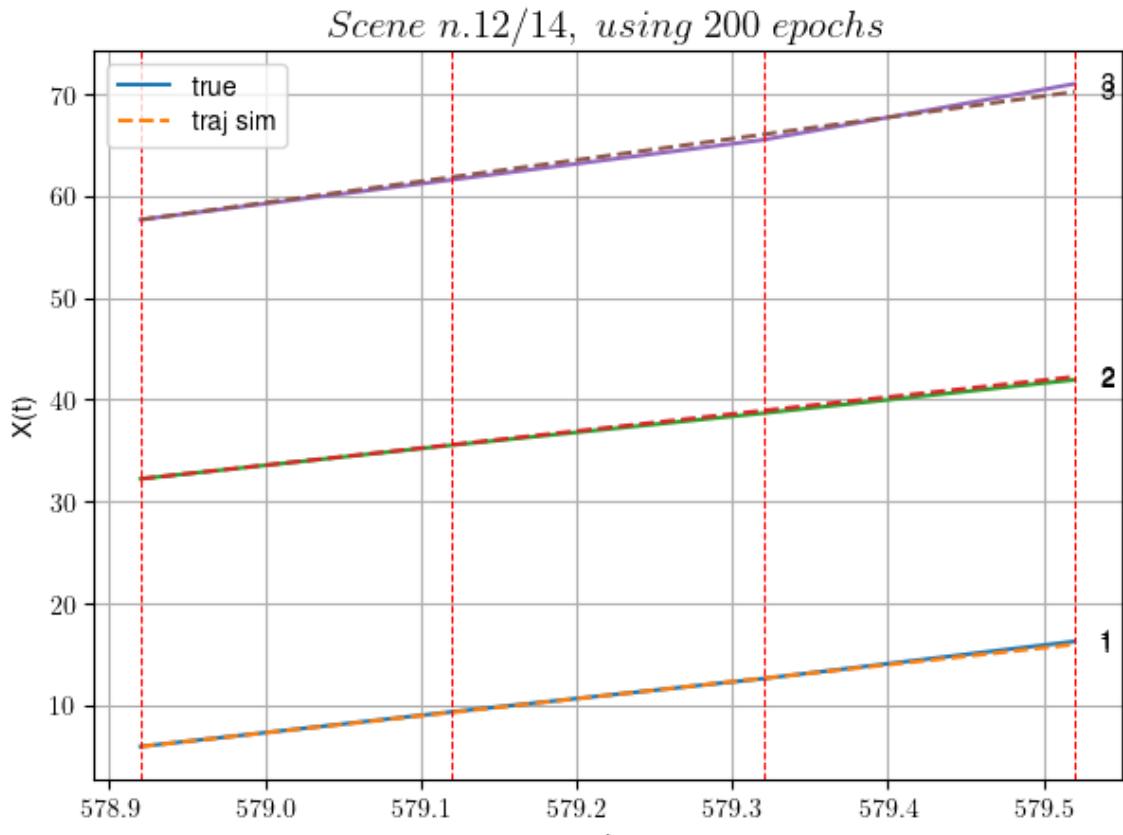
---

---

Scene n.12/14, time interval:[578.92,579.52]

---

---



Loss: 0.10131812526362068  
v0 updated: 20.92658502941081

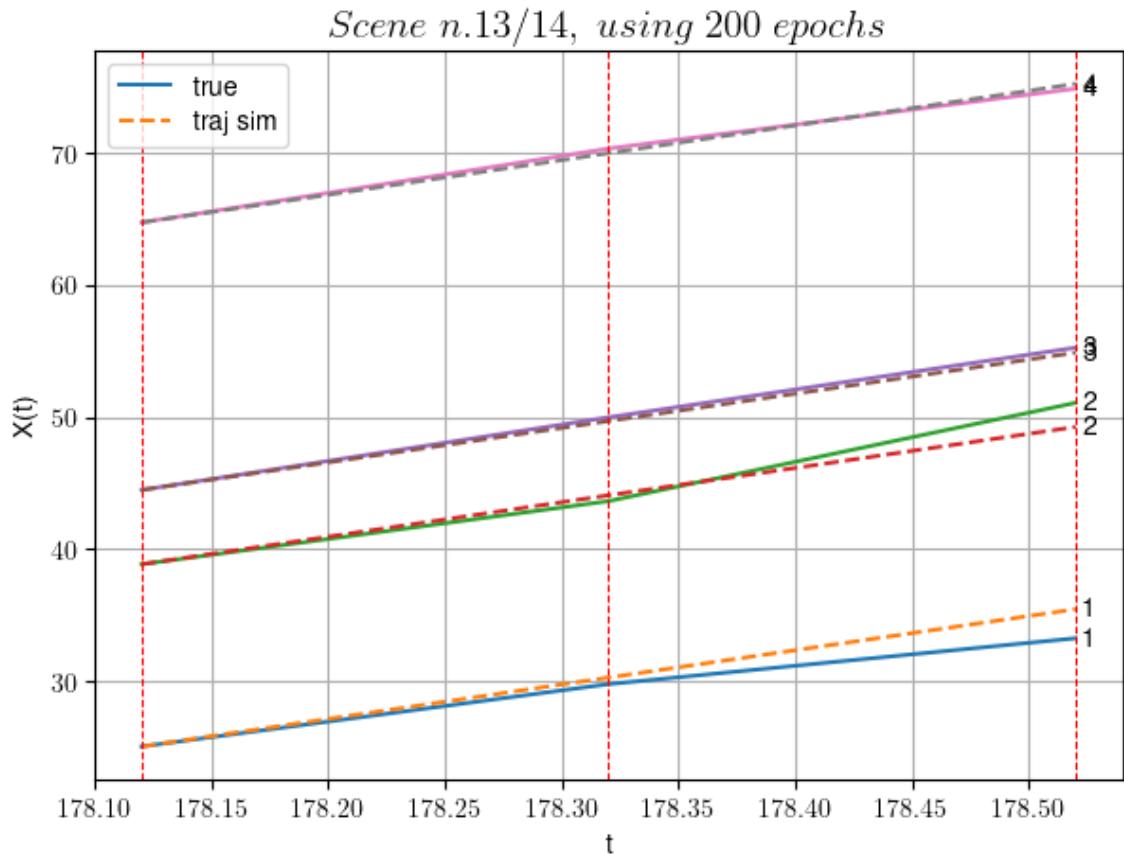
---

---

Scene n.13/14, time interval:[178.12,178.52]

---

---



Loss: 0.75631511870789  
v0 updated: 26.21582356930081

---



---

v0\_mean in this df is: 27.19929737761663  
Time taken: 70.02s  
Hidden-Layer-1/kernel:0: [-1.0314503e+01 -7.5116525e+00 -1.2637139e+05 -6.0159552e+02]  
Hidden-Layer-1/bias:0: [ -9.177155 -7.33252 -6253.4644 -341.692 ]  
Output-Layer/kernel:0: [-1.7941561e+00 4.7476025e+00 -1.5931100e+05 1.4249943e+01]  
Output-Layer/bias:0: [26.078182]

---



---

In df n.6/10 we have 3 scenes

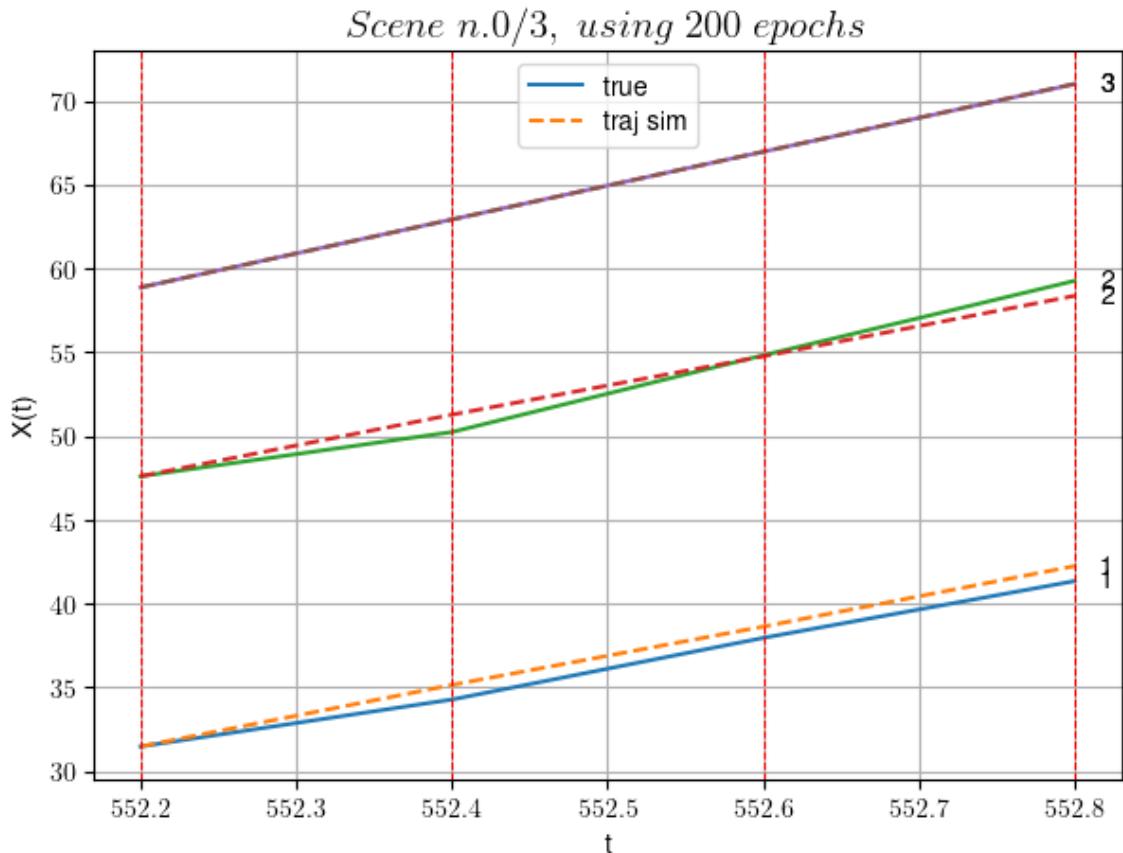
---

Scene n.0/3, time interval:[552.20,552.80]

---



---



Loss: 0.32439807488629924  
v0 updated: 20.243929110422304

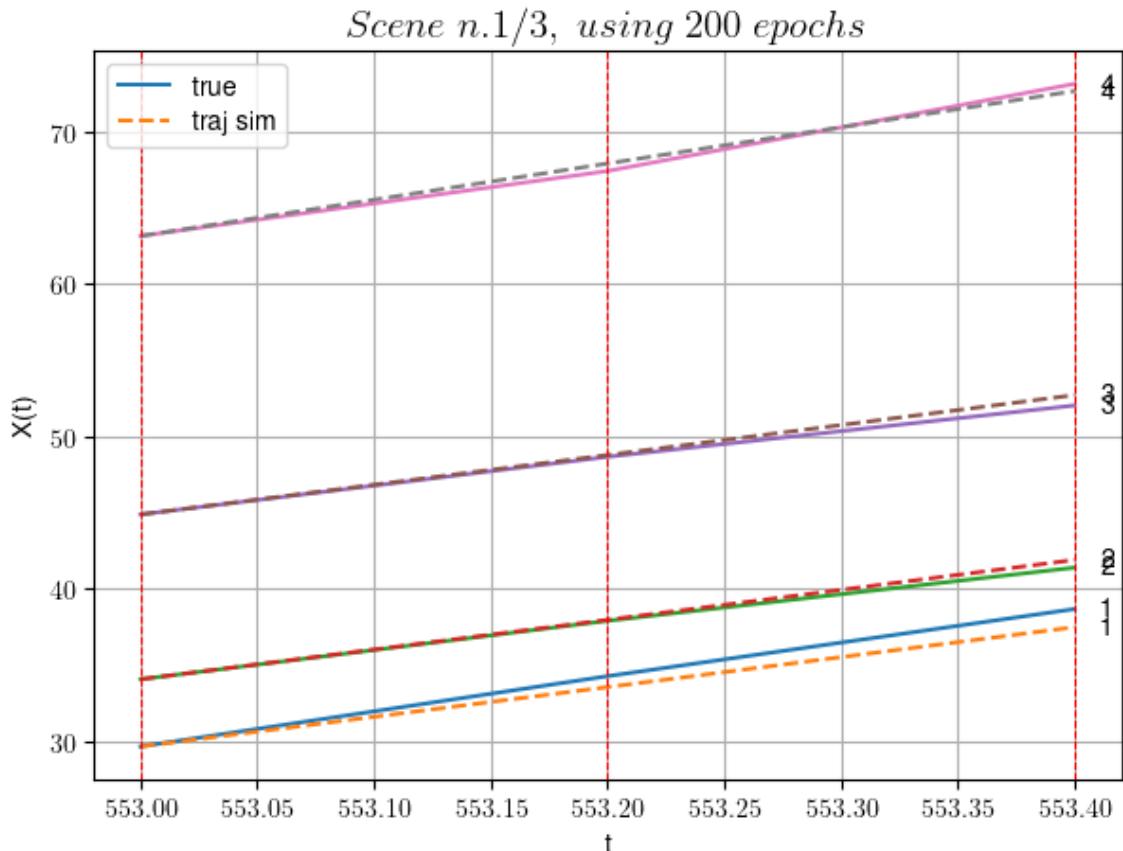
---

---

Scene n.1/3, time interval:[553.00,553.40]

---

---



Loss: 0.2608910317315331  
v0 updated: 23.787330449337816

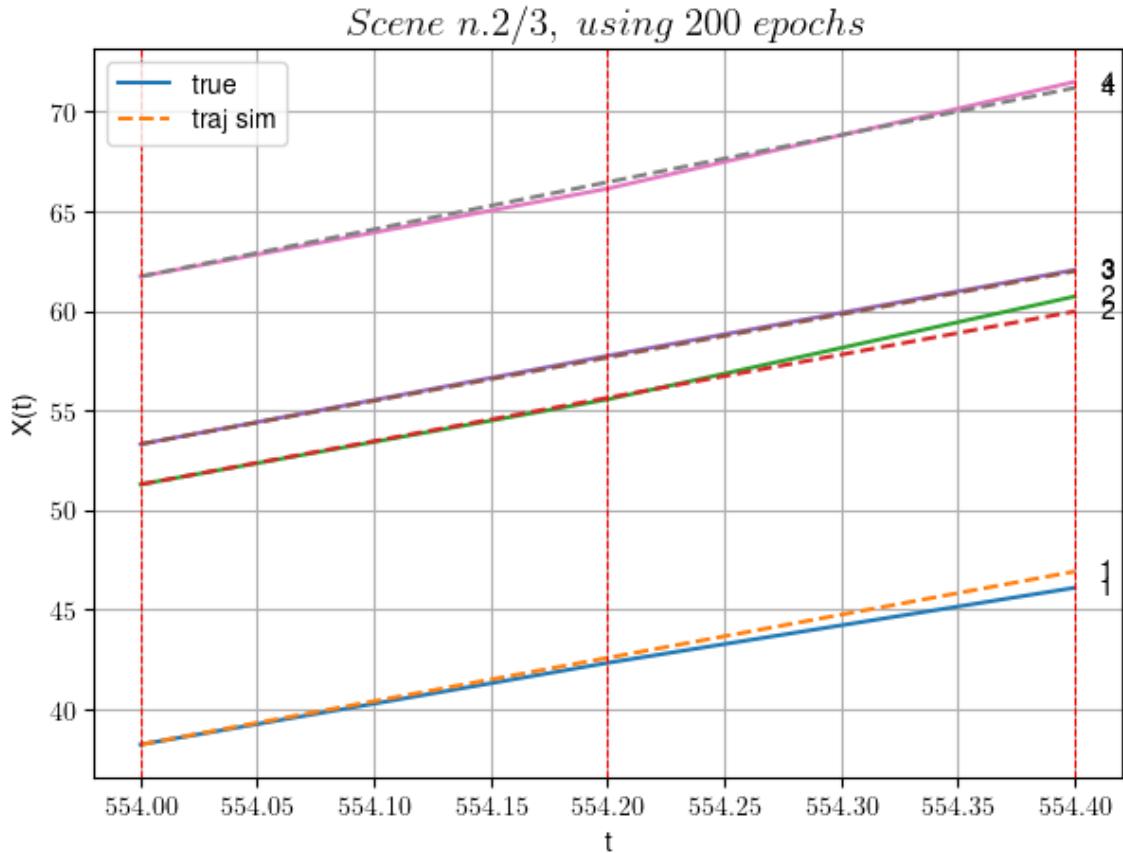
---

---

Scene n.2/3, time interval:[554.00,554.40]

---

---



```
v0_mean in this df is: 23.859329124959213
Time taken: 11.99s
Hidden-Layer-1/kernel:0: [-1.0314503e+01 -7.5116525e+00 -1.
2637139e+05 -6.0159552e+02]
Hidden-Layer-1/bias:0: [ -9.177155      -7.33252     -6253.4644     -
341.692 ]
Output-Layer/kernel:0: [-1.7941561e+00  4.7476025e+00 -1.5931100
e+05  1.4249943e+01]
Output-Layer/bias:0: [21.762316]
```

---



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---

In df n.7/10 we have 8 scenes

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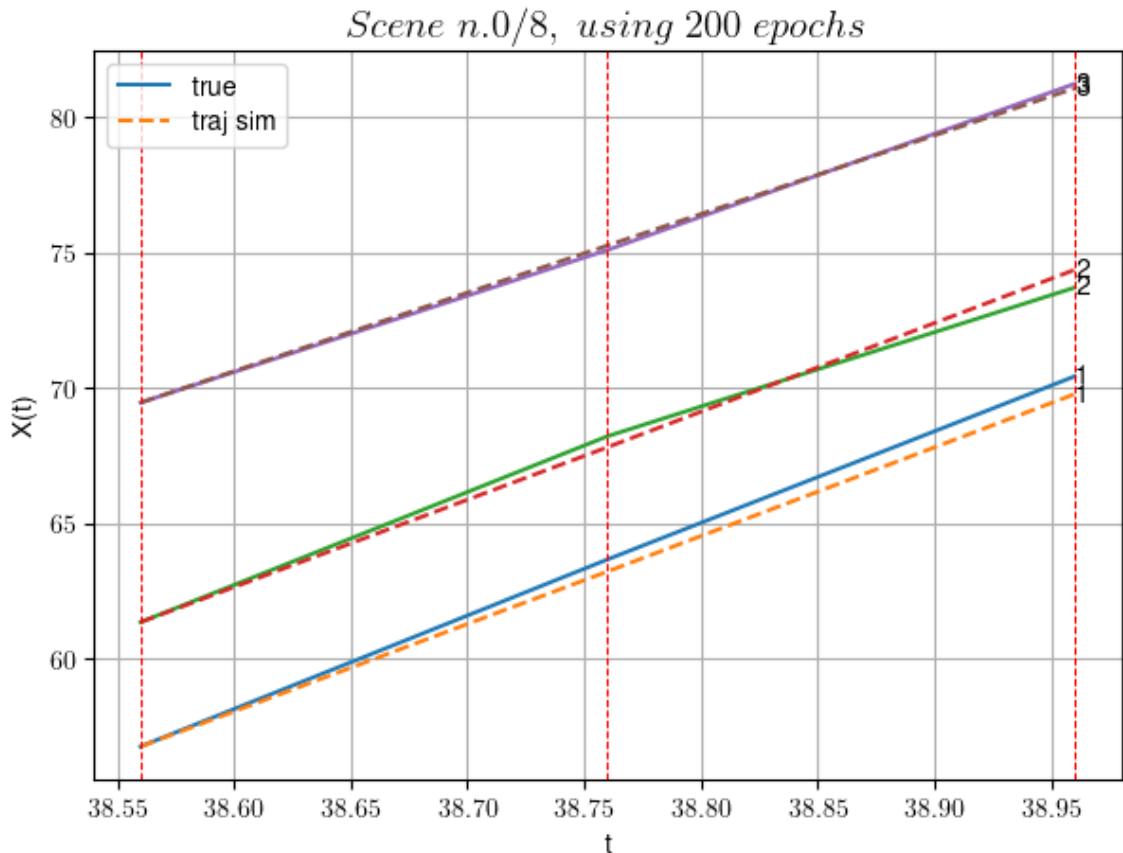
---



---

Scene n.0/8, time interval:[38.56,38.96]

---



Loss: 0.14196907898337394  
v0 updated: 28.991119571901432

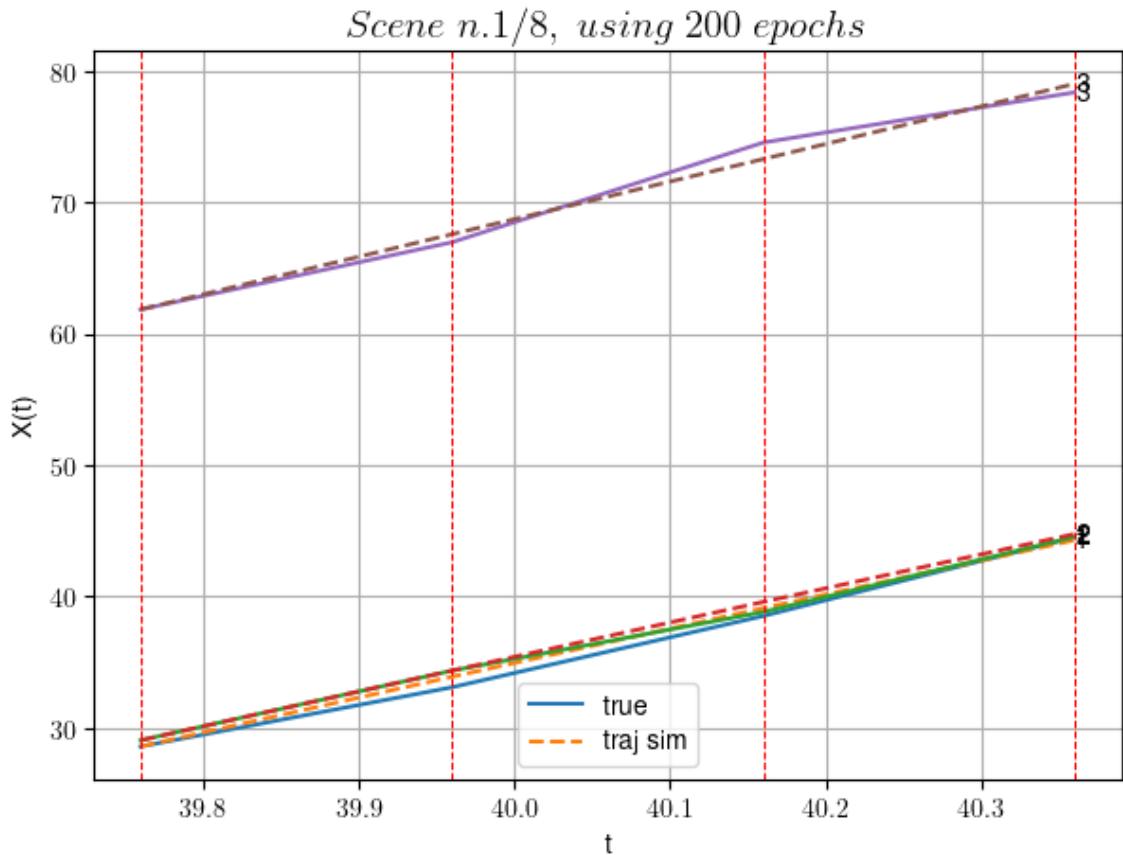
---

---

Scene n.1/8, time interval:[39.76,40.36]

---

---



Loss: 0.3382702615171307  
v0 updated: 28.63125727112906

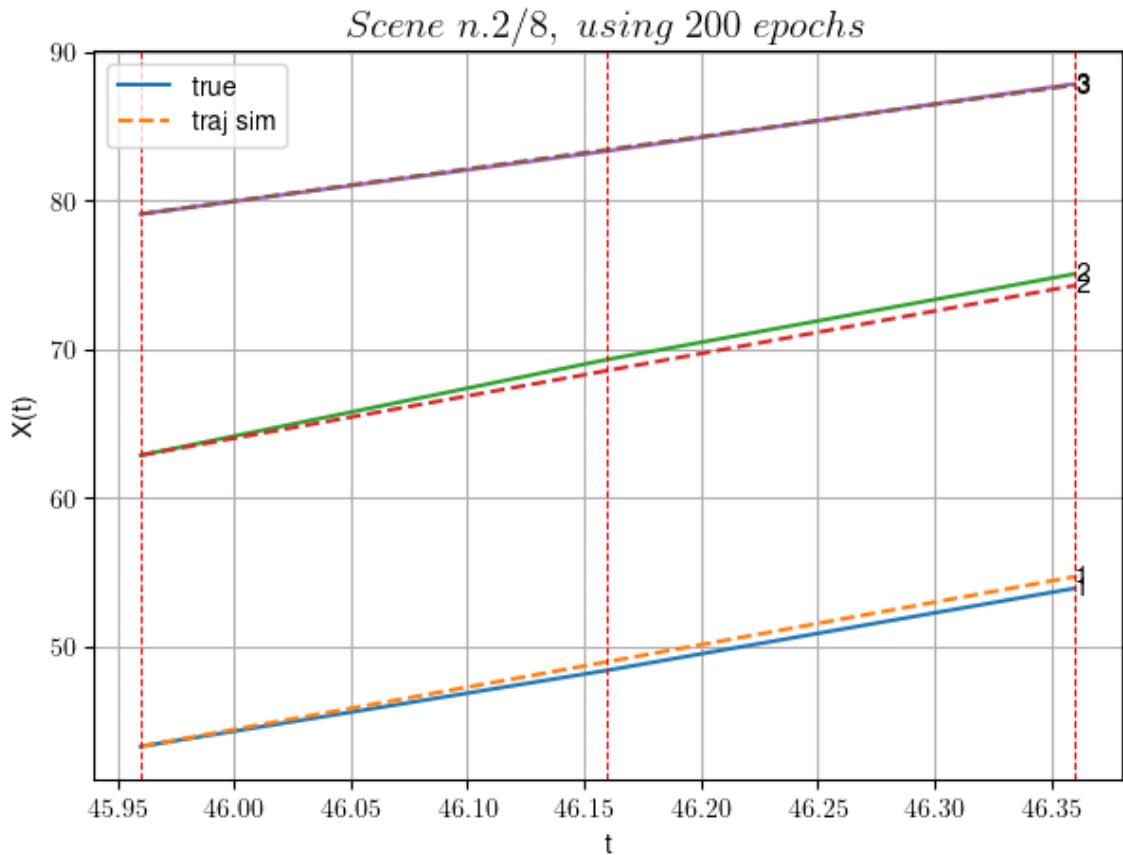
---

---

Scene n.2/8, time interval:[45.96,46.36]

---

---



Loss: 0.2360679258220193  
v0 updated: 21.688502462638503

---

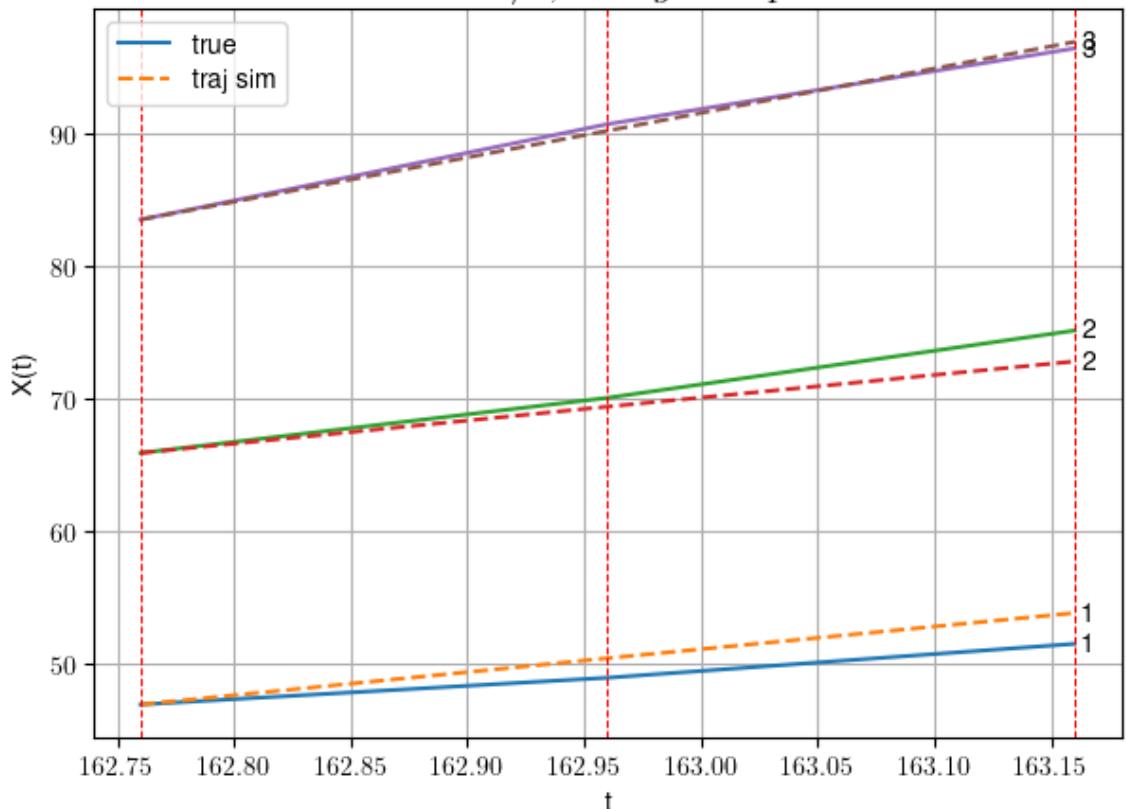
---

Scene n.3/8, time interval:[162.76,163.16]

---

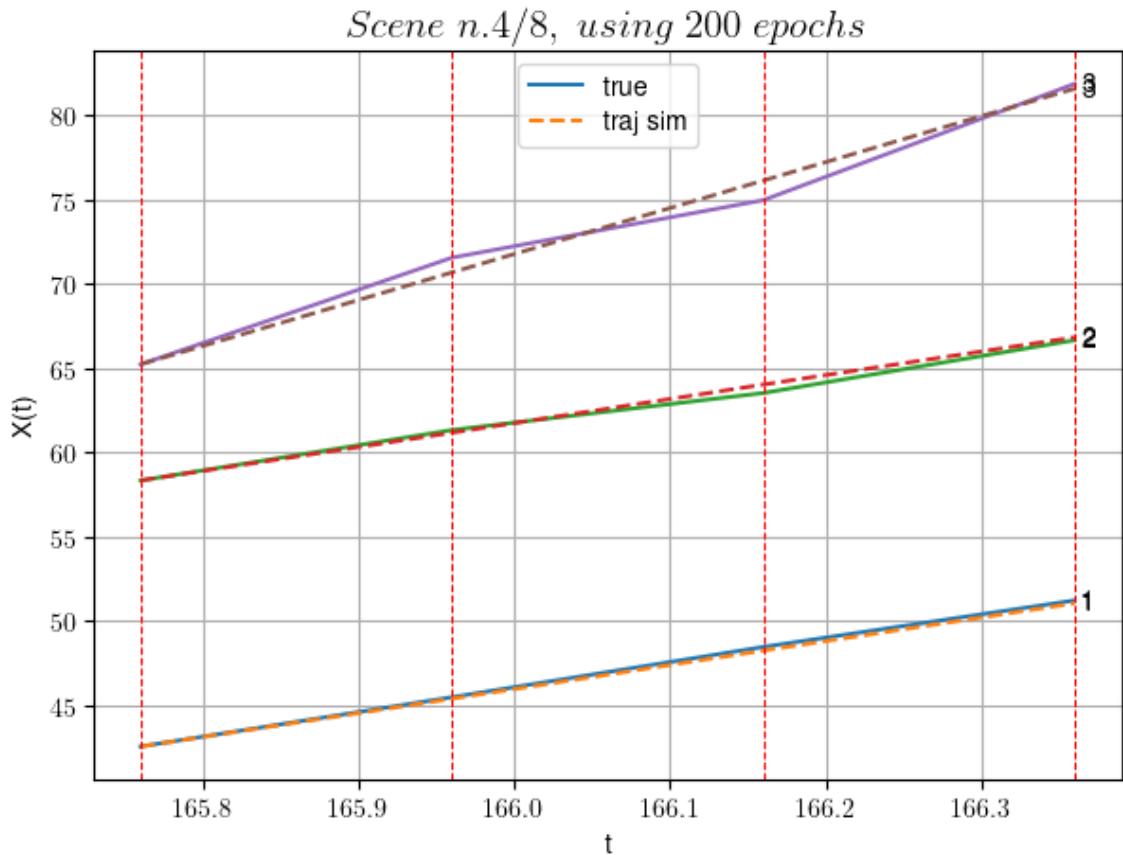
---

Scene n.3/8, using 200 epochs



Loss: 1.5490462092889077  
v0 updated: 33.51069558869736

Scene n.4/8, time interval:[165.76,166.36]



Loss: 0.21631944698967723  
v0 updated: 27.26521595497116

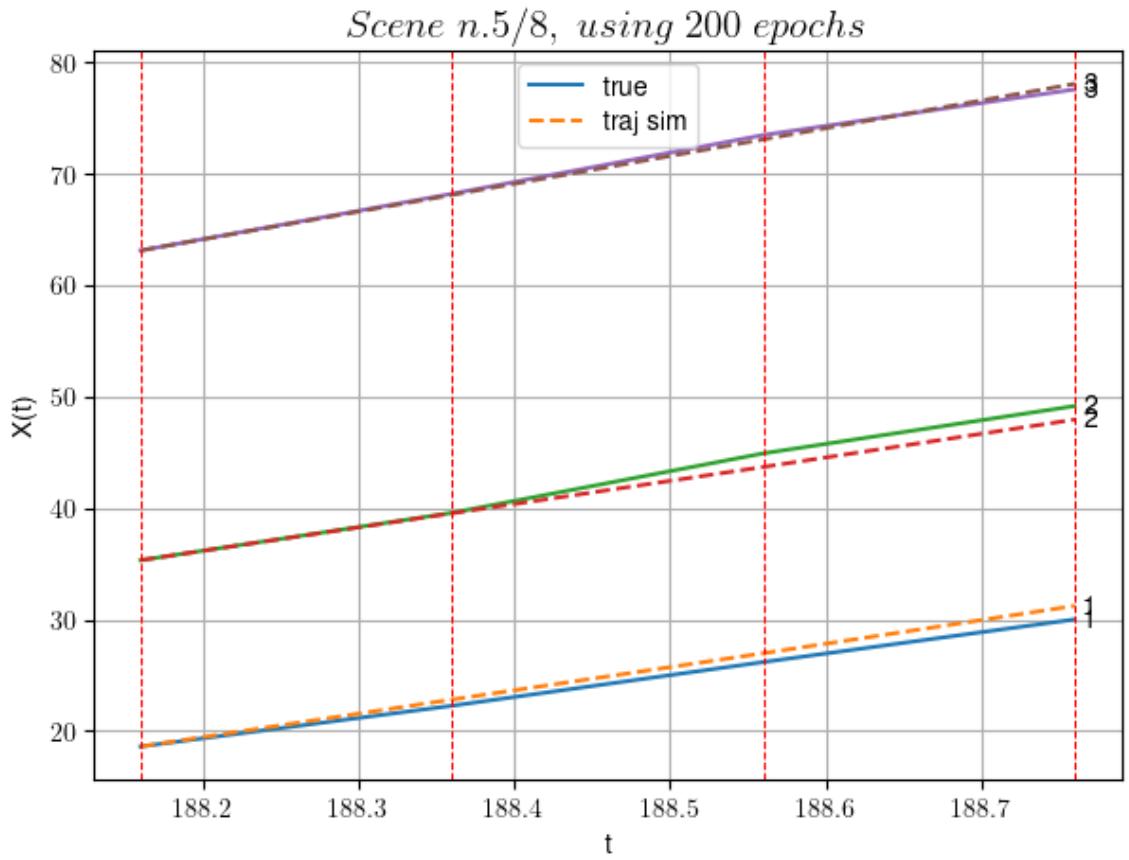
---

---

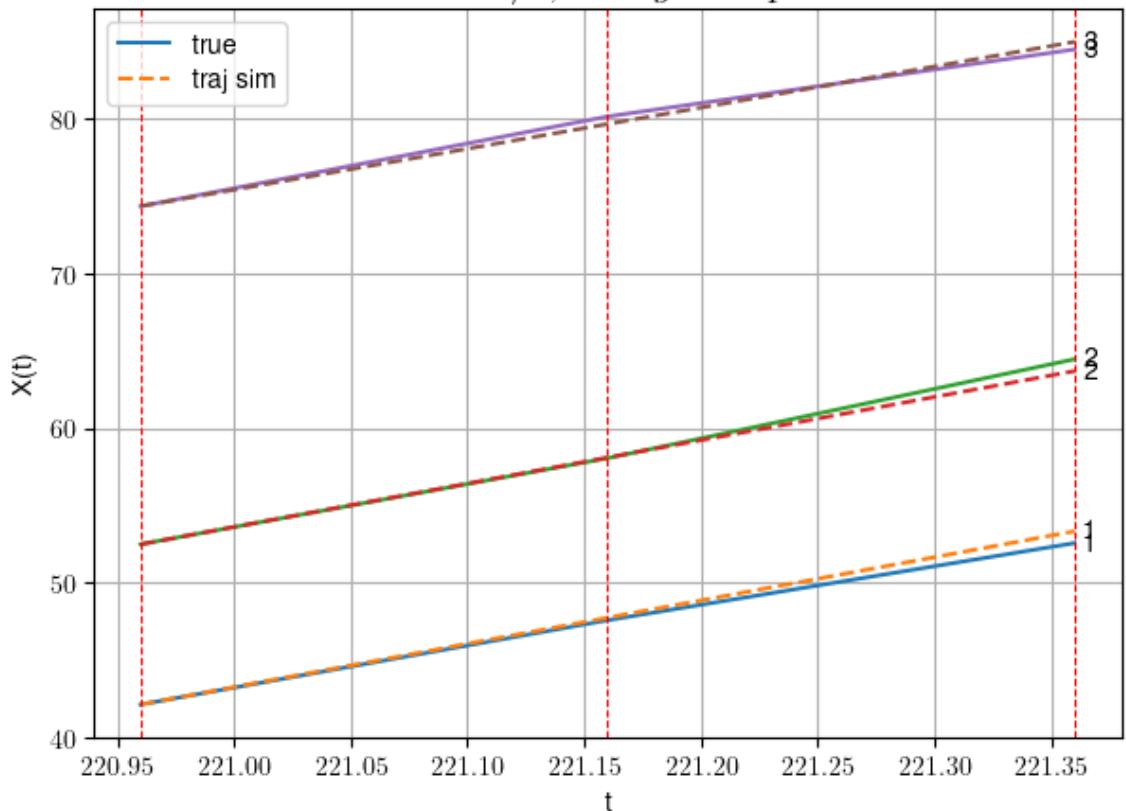
Scene n.5/8, time interval:[188.16,188.76]

---

---



Scene n.6/8, time interval:[220.96,221.36]

*Scene n.6/8, using 200 epochs*

Loss: 0.18637988037752853  
v0 updated: 26.583600781325373

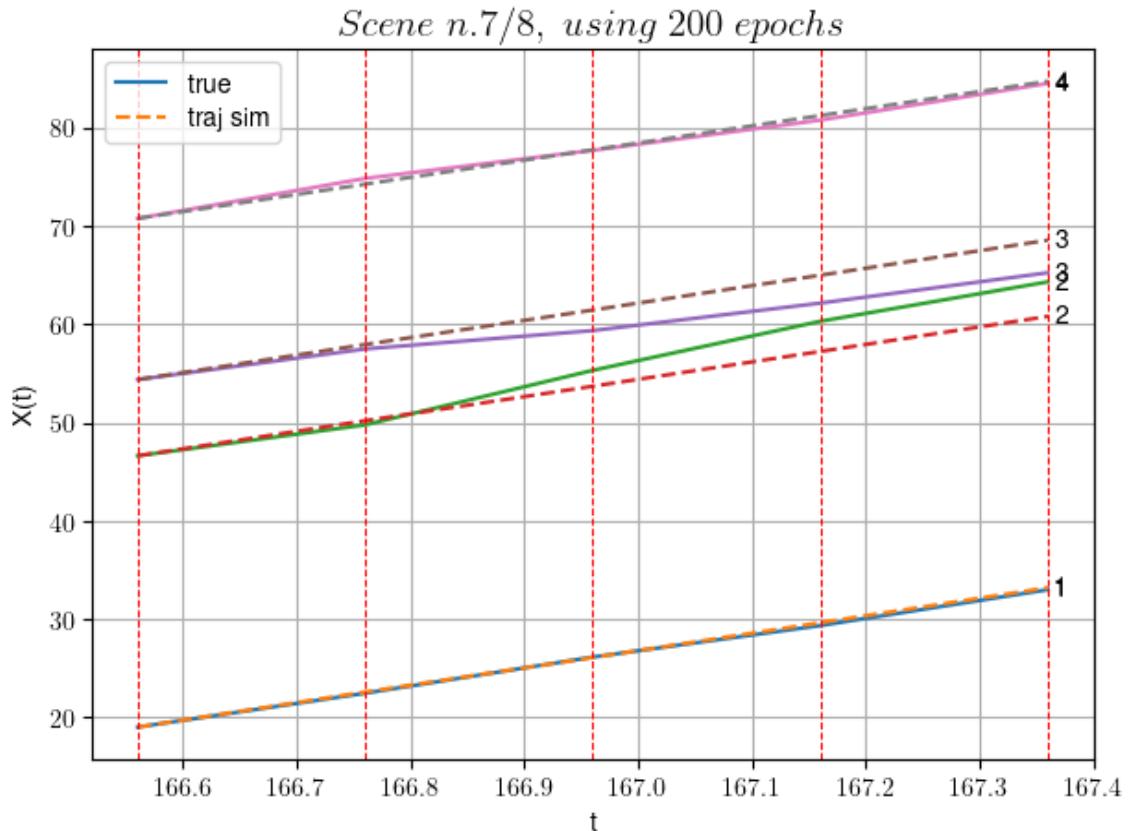
---

---

Scene n.7/8, time interval:[166.56,167.36]

---

---



Loss: 2.447206697686136  
 $v_0$  updated: 17.446466440824256

---



---

$v_0$ \_mean in this df is: 26.771402099536605  
 Time taken: 34.41s  
 Hidden-Layer-1/kernel:0: [-1.0314692e+01 -7.5069122e+00 -1.  
 2637139e+05 -6.0159552e+02]  
 Hidden-Layer-1/bias:0: [ -9.17772 -7.3150578 -6253.4644  
 -341.692 ]  
 Output-Layer/kernel:0: [-1.7938735e+00 4.7512884e+00 -1.5931100  
 e+05 1.4249943e+01]  
 Output-Layer/bias:0: [17.854322]

---



---

In df n.8/10 we have 21 scenes

---



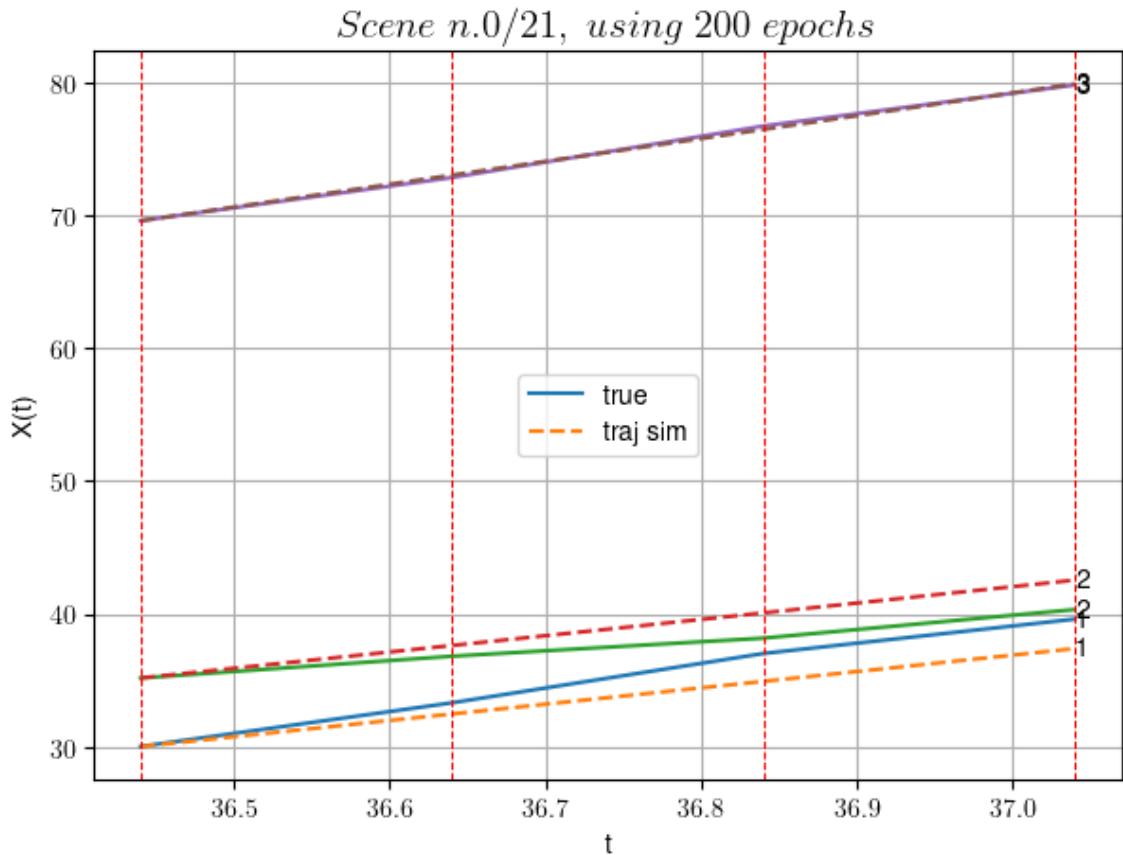
---

Scene n.0/21, time interval:[36.44,37.04]

---



---



Loss: 1.60714835729267  
v0 updated: 17.17089794364062

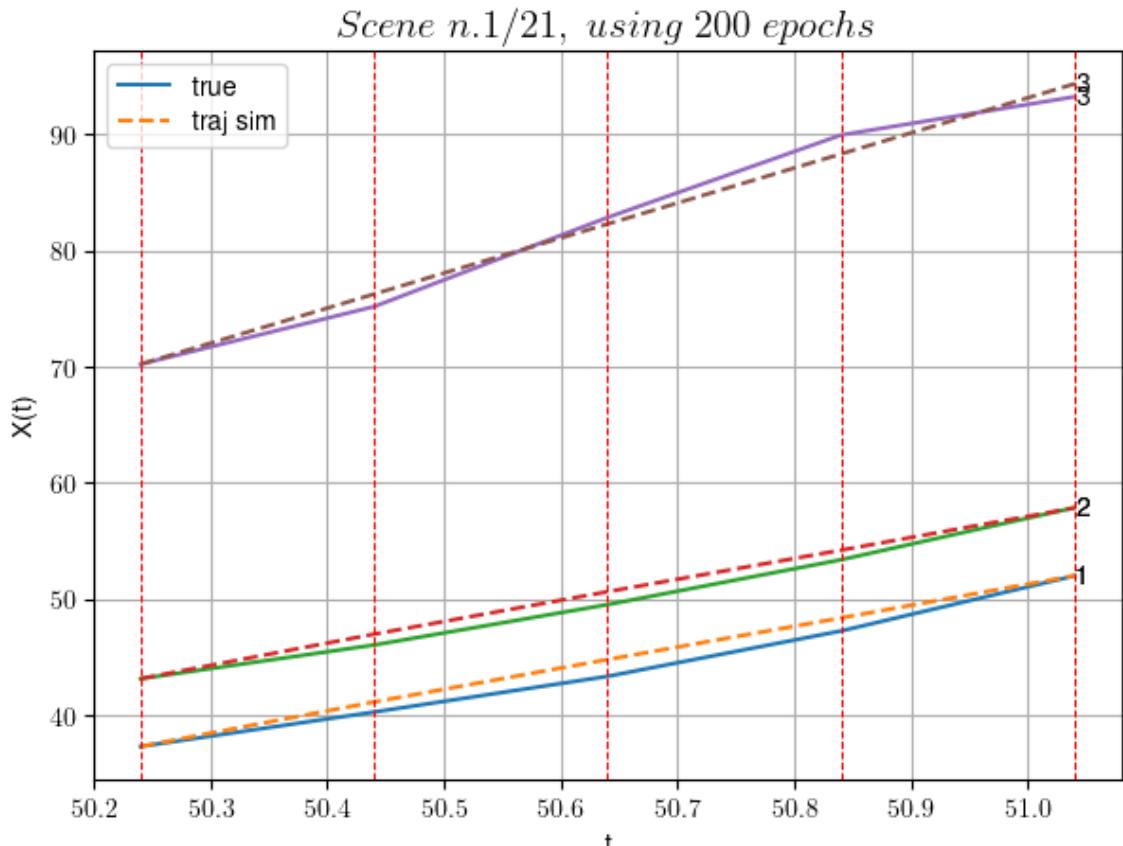
---

---

Scene n.1/21, time interval:[50.24,51.04]

---

---



Loss: 0.8178821959403538  
v0 updated: 30.15748786026172

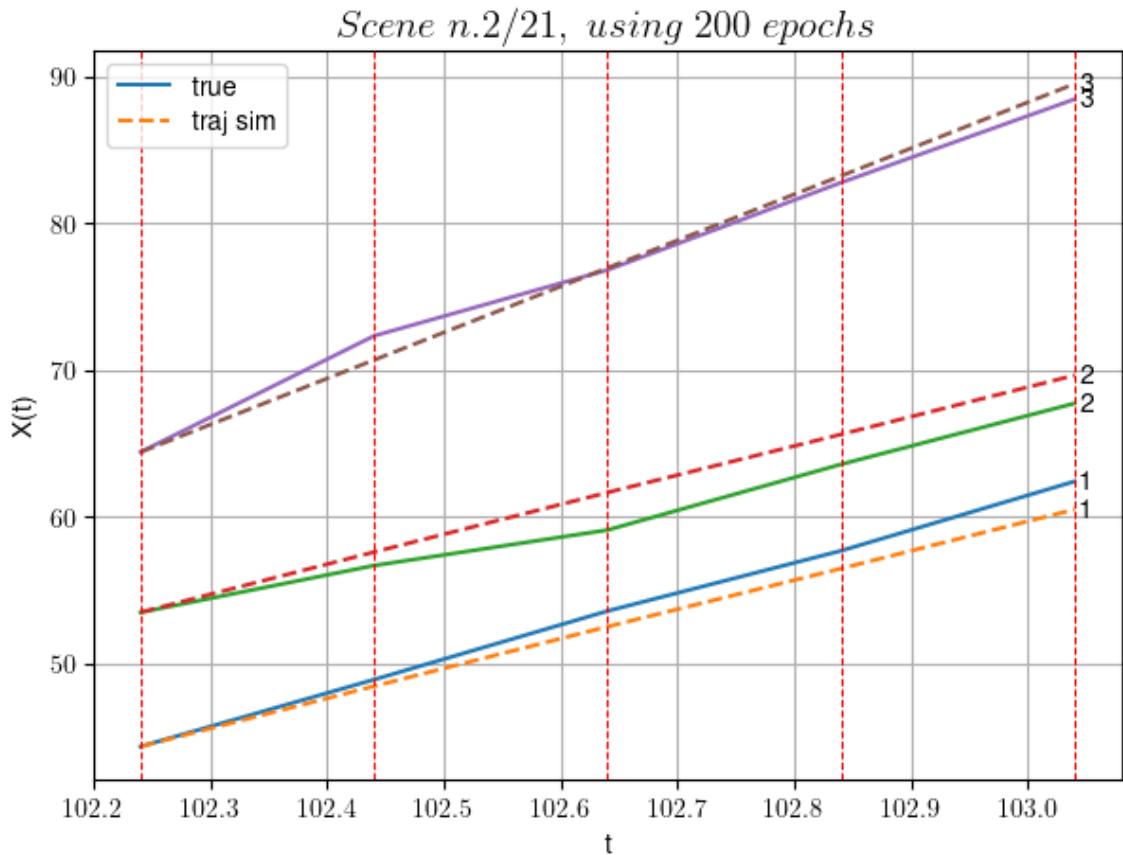
---

---

Scene n.2/21, time interval:[102.24,103.04]

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---



Loss: 1.7094574889259455  
v0 updated: 31.34681154077697

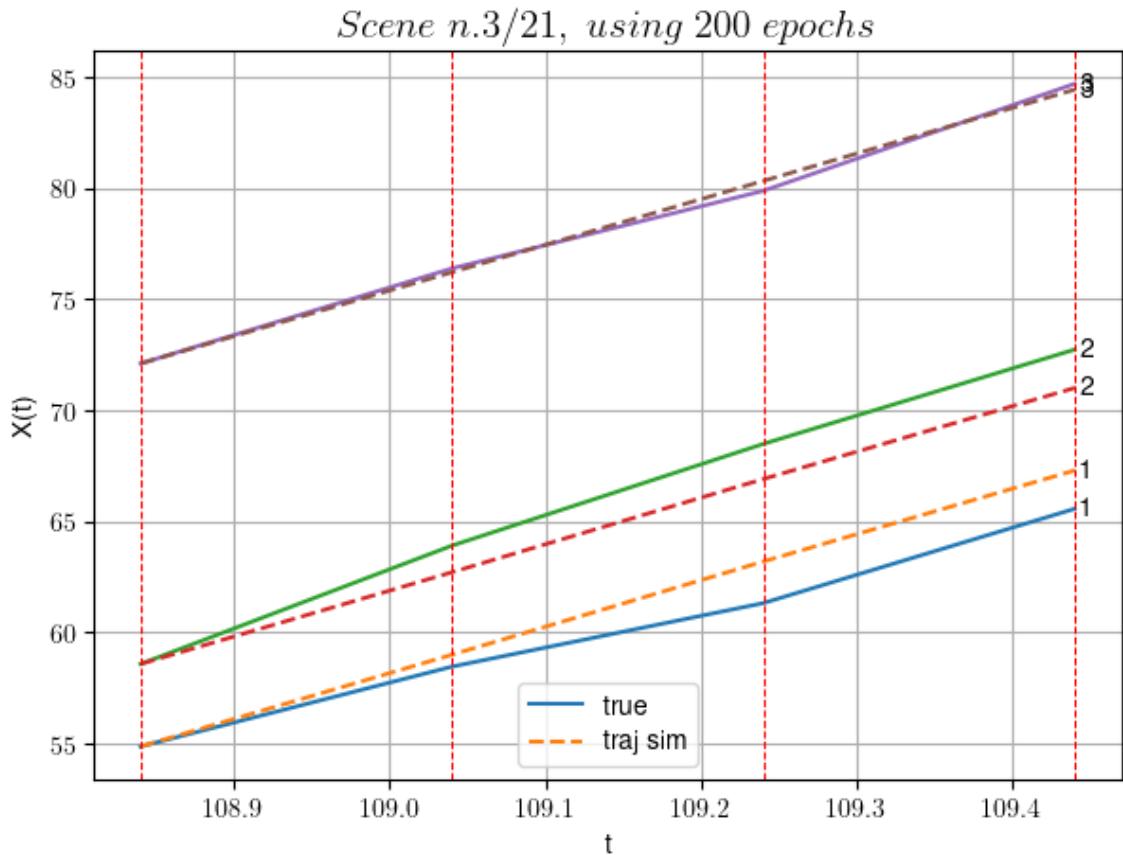
---

---

Scene n.3/21, time interval:[108.84,109.44]

---

---



Loss: 1.166618330669097  
v0 updated: 20.559392419821574

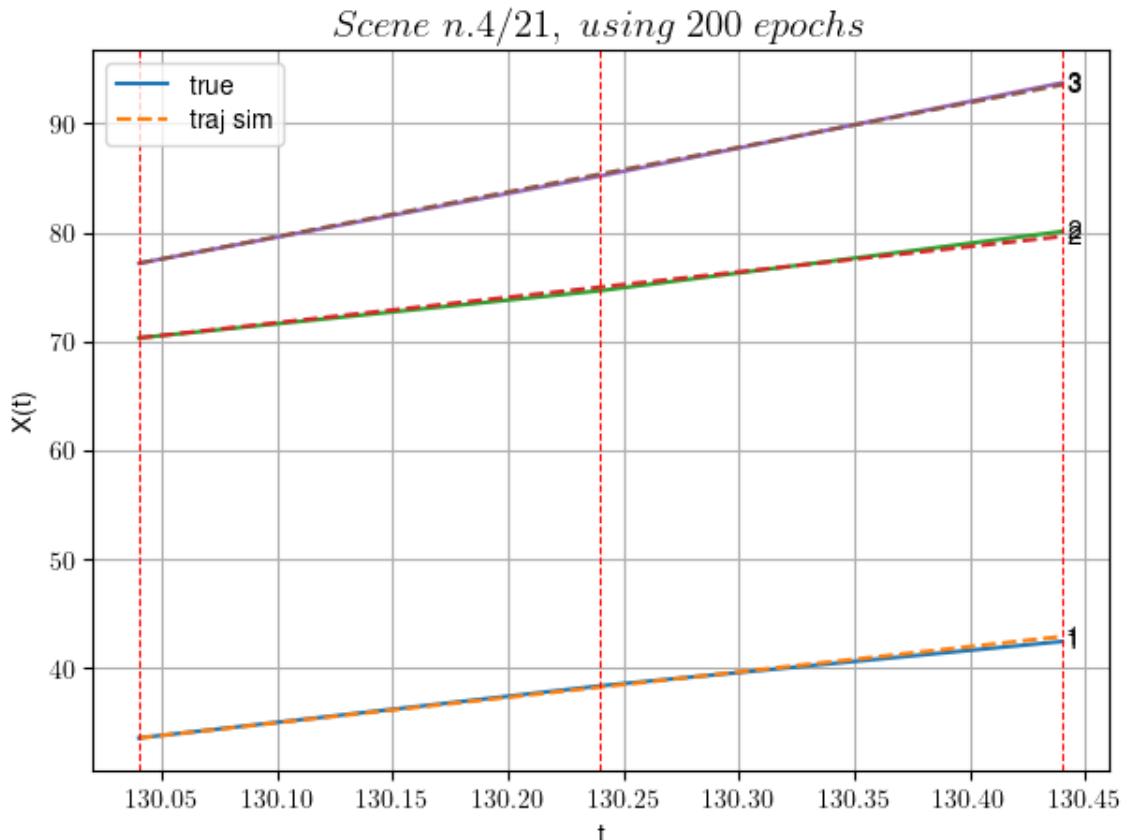
---

---

Scene n.4/21, time interval:[130.04,130.44]

---

---



Loss: 0.06782294220729948  
v0 updated: 41.04348308440233

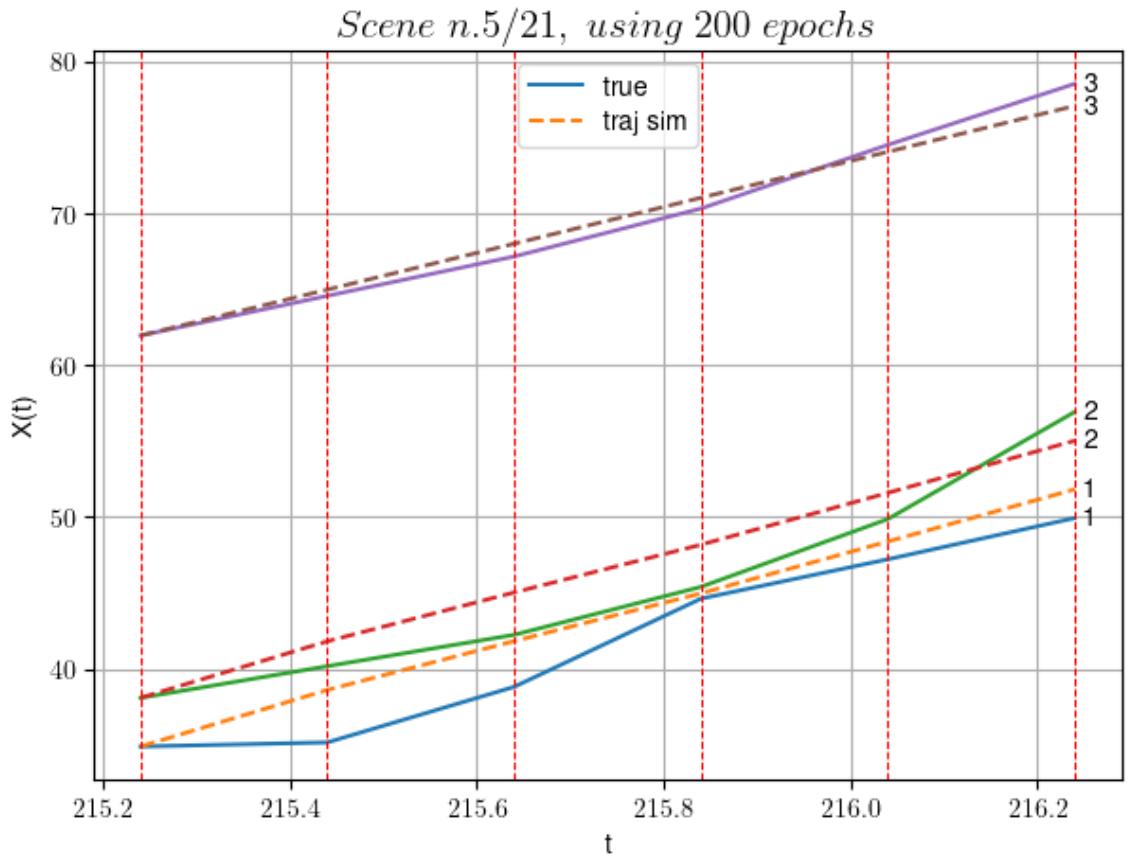
---

---

Scene n.5/21, time interval:[215.24,216.24]

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---



Loss: 3.025813310919123  
v0 updated: 15.117049251683454

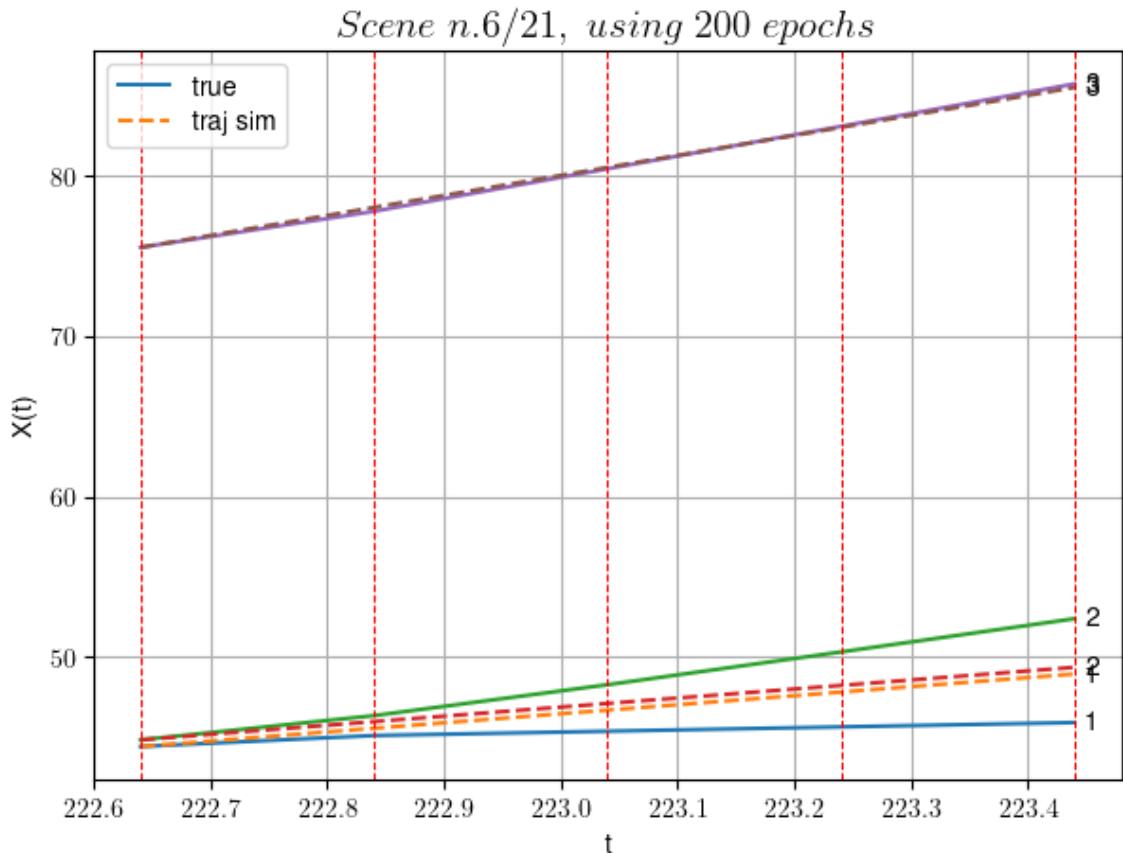
---

---

Scene n.6/21, time interval:[222.64,223.44]

---

---



Loss: 2.059846677211429  
v0 updated: 12.44783182194636

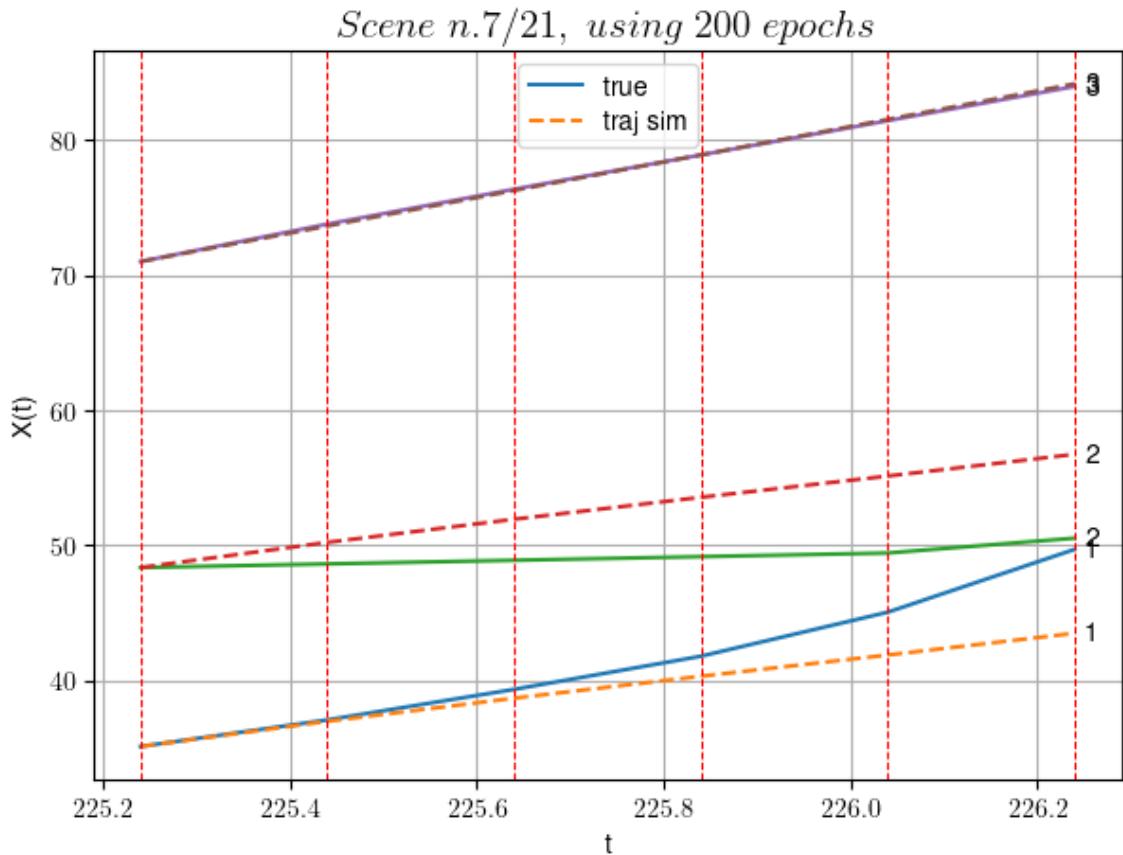
---

---

Scene n.7/21, time interval:[225.24,226.24]

---

---



Loss: 8.527268656929602  
v0 updated: 13.162191858706763

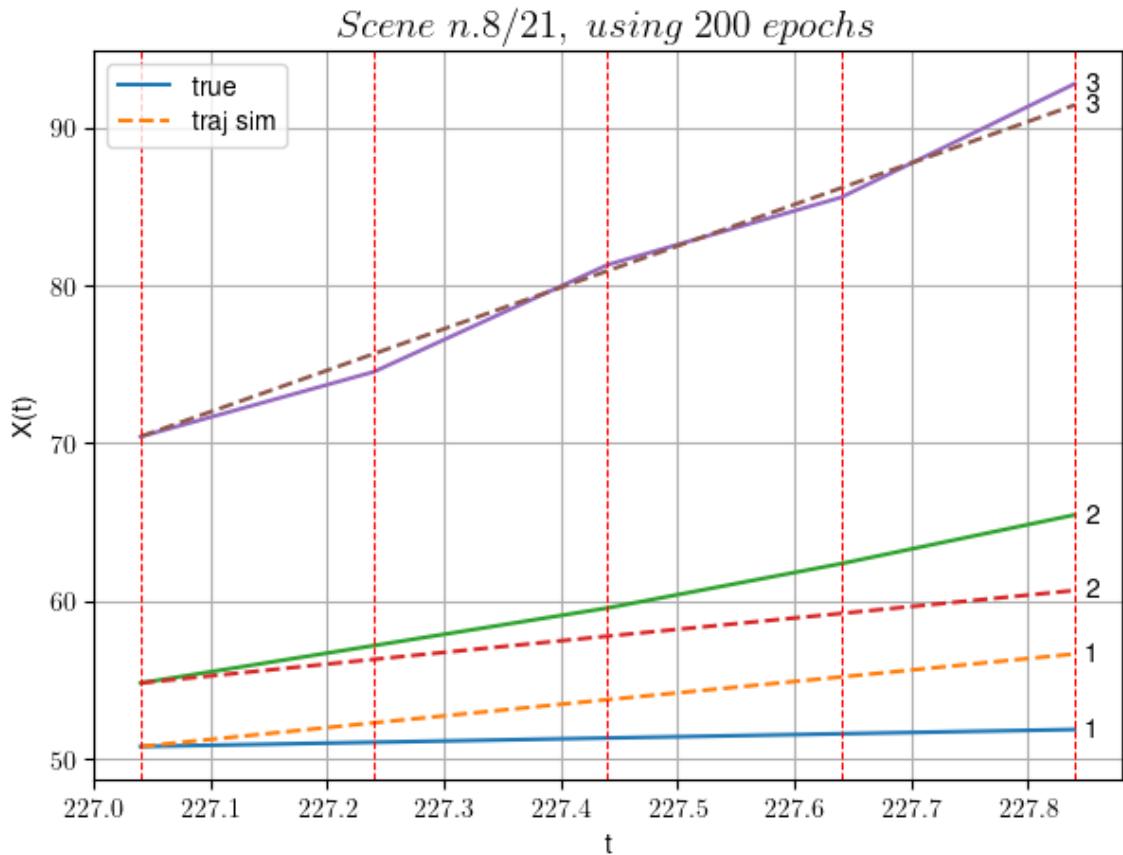
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---

Scene n.8/21, time interval:[227.04,227.84]

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---



Loss: 5.577761819347756  
v0 updated: 26.247280530693132

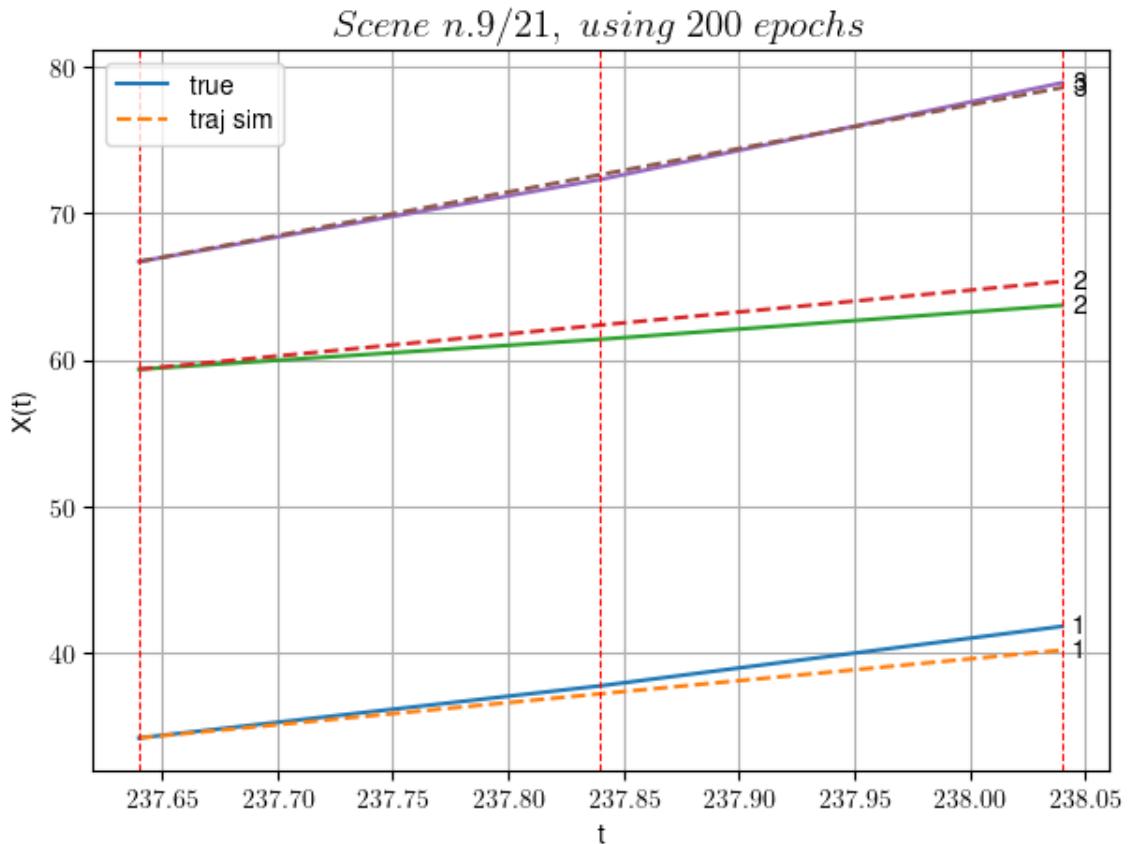
---

---

Scene n.9/21, time interval:[237.64,238.04]

---

---

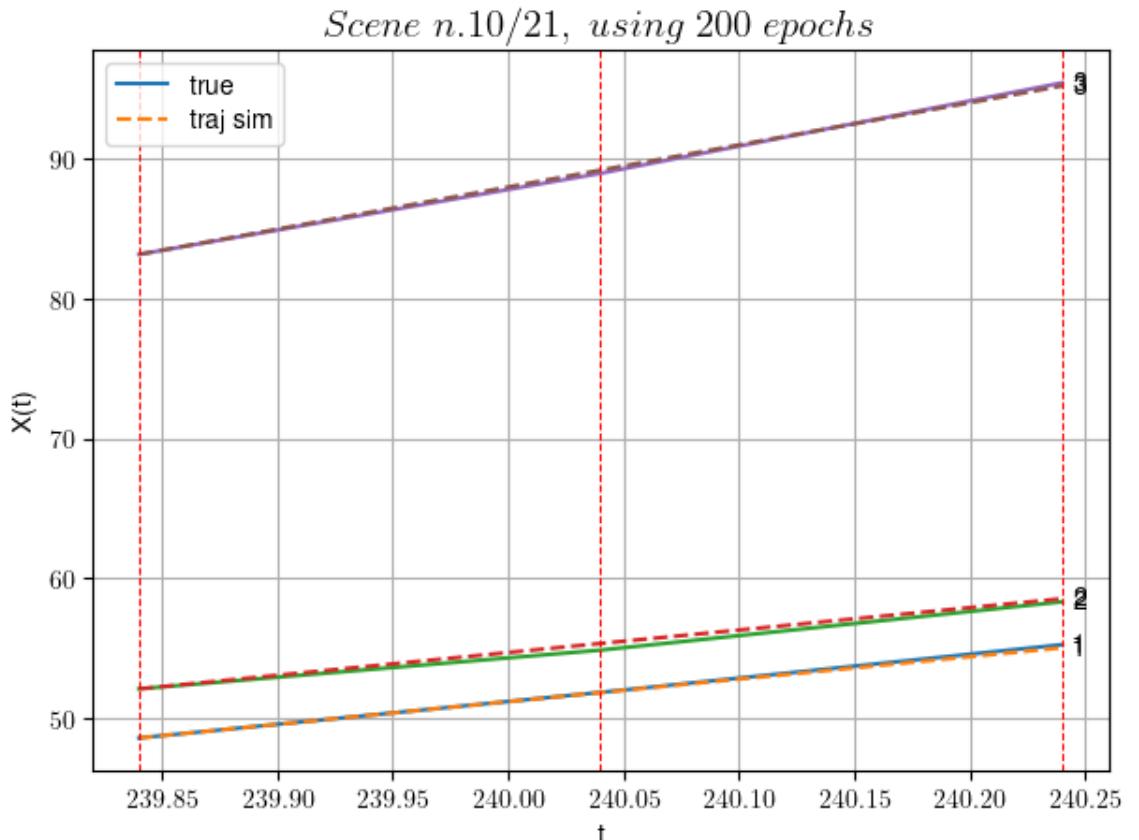


Loss: 0.7498044822730331  
v0 updated: 29.70329363802171

---

Scene n.10/21, time interval:[239.84,240.24]

---

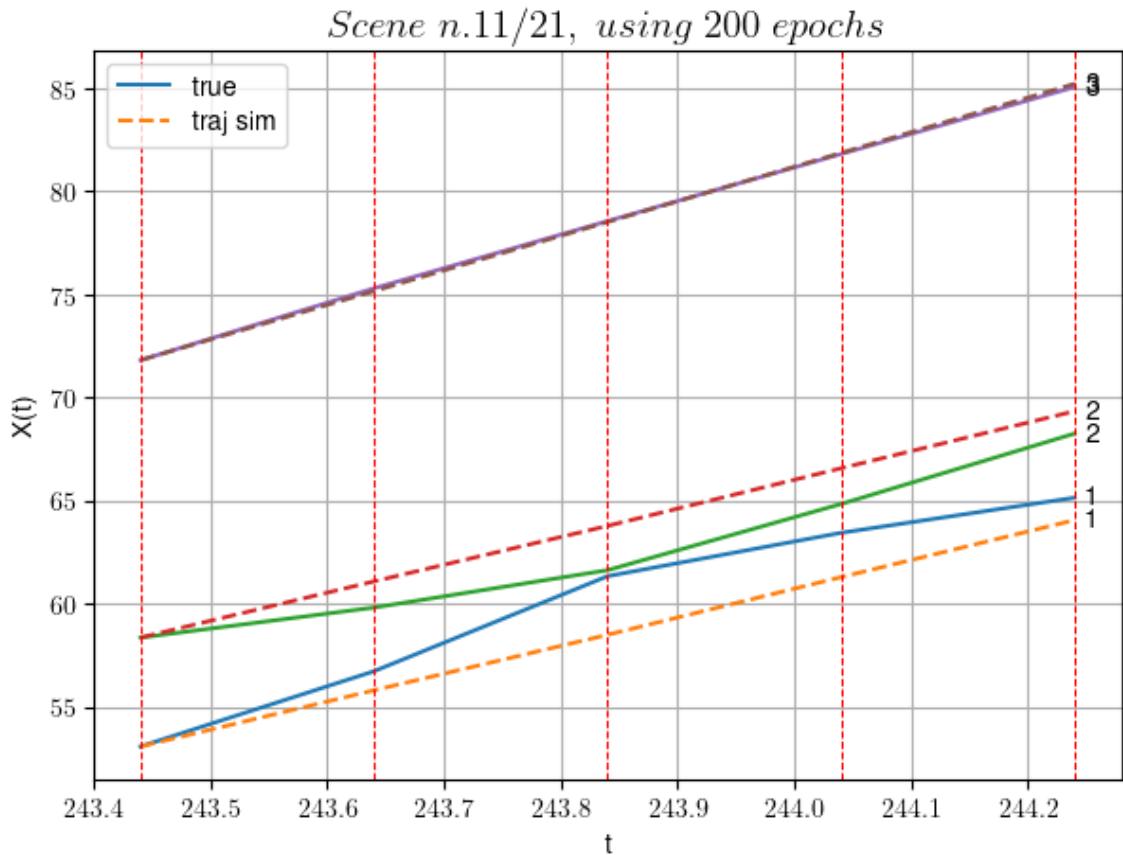


Loss: 0.047612652223725134  
v0 updated: 30.13109543583857

---

Scene n.11/21, time interval:[243.44,244.24]

---



Loss: 1.680525275812551  
v0 updated: 16.757470726649434

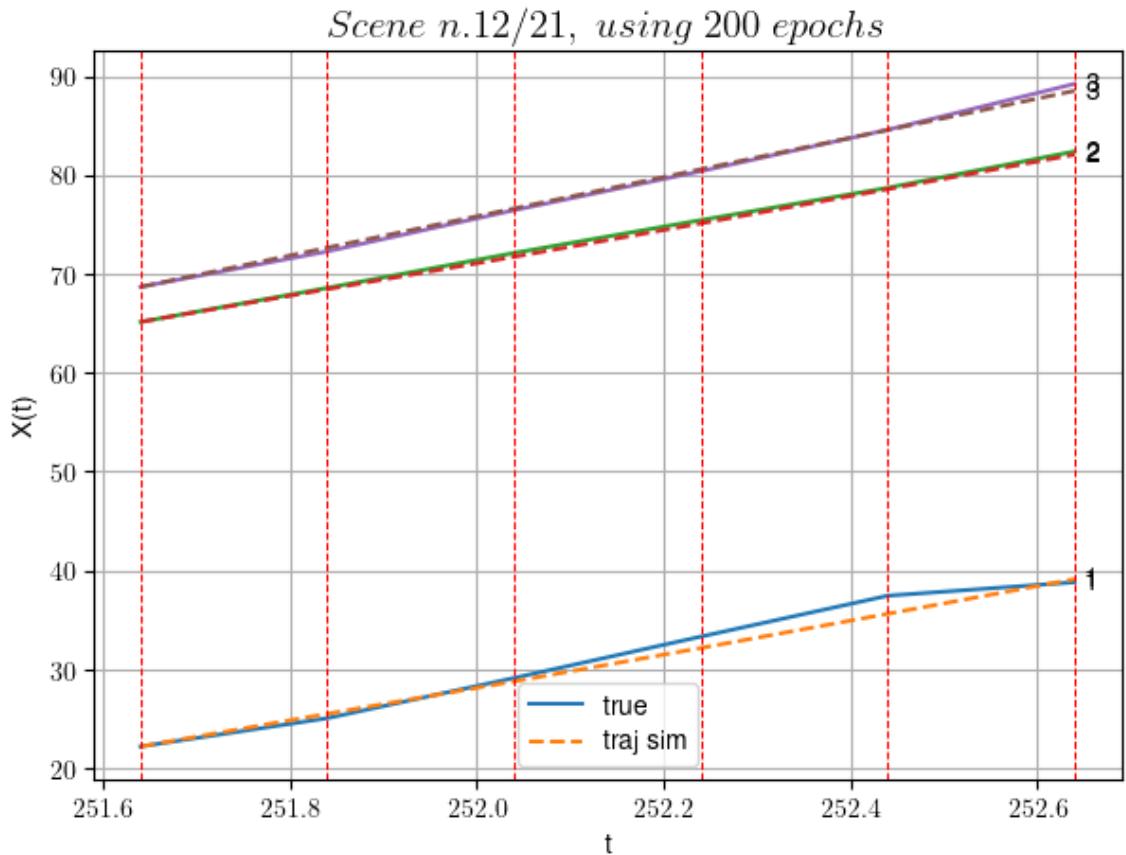
---

---

Scene n.12/21, time interval:[251.64,252.64]

---

---



Loss: 0.34468700930210056  
v0 updated: 19.83607847657935

---

---

Scene n.13/21, time interval:[290.84,291.44]

---

---



Loss: 3.3398397193157607  
v0 updated: 25.383319029072275

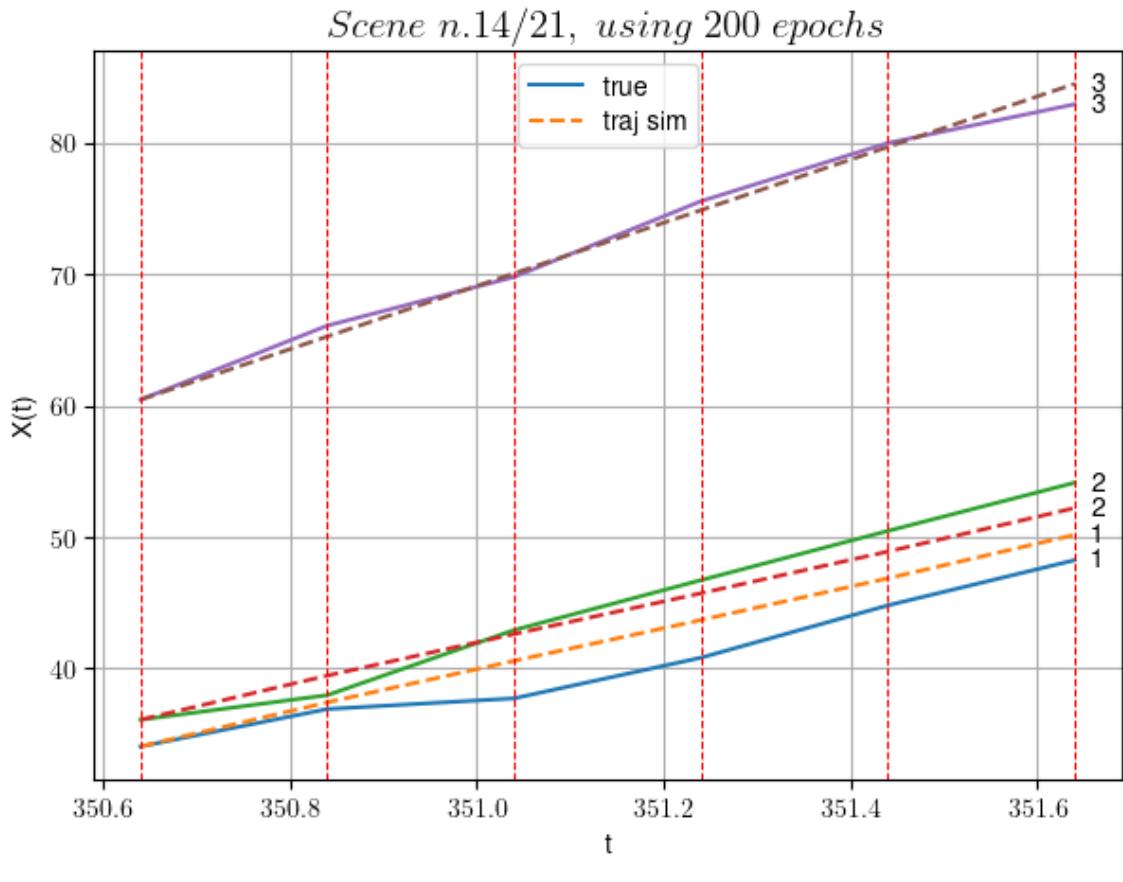
---

---

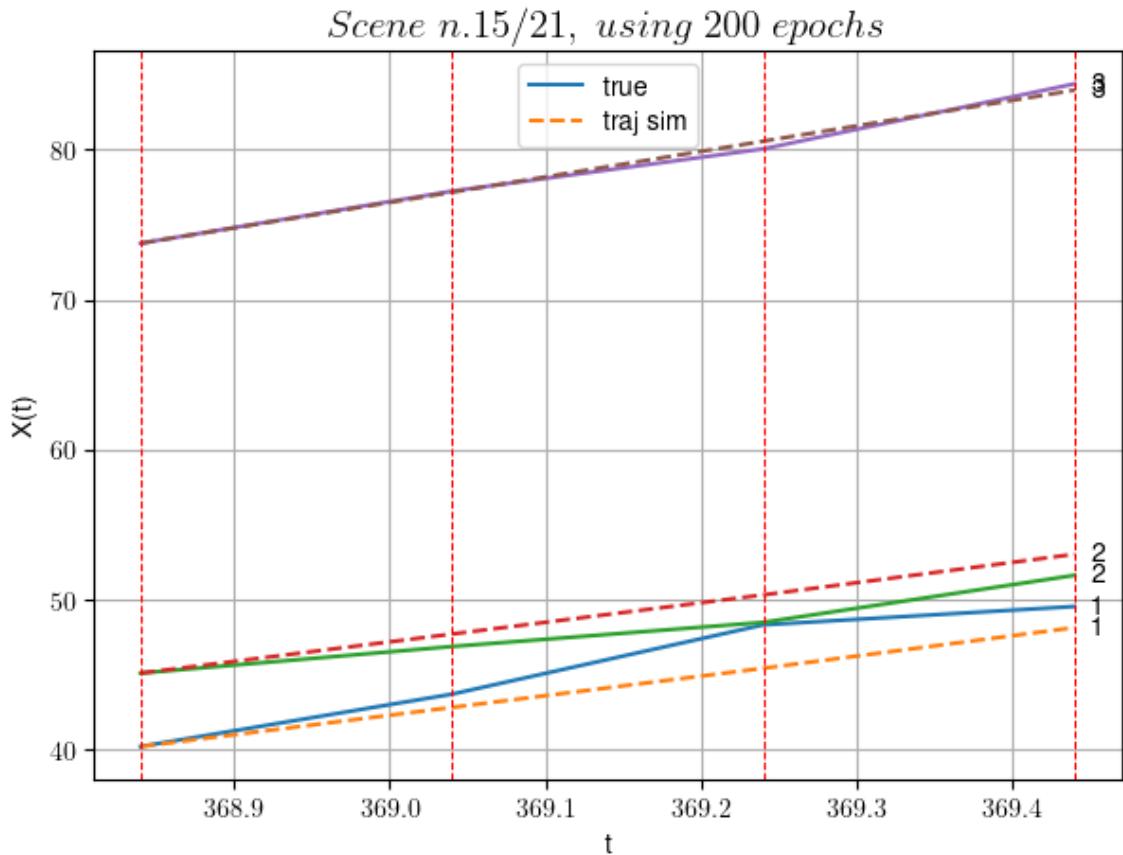
Scene n.14/21, time interval:[350.64,351.64]

---

---



Scene n.15/21, time interval:[368.84,369.44]



Loss: 1.467927243643491  
v0 updated: 17.02627298452667

---

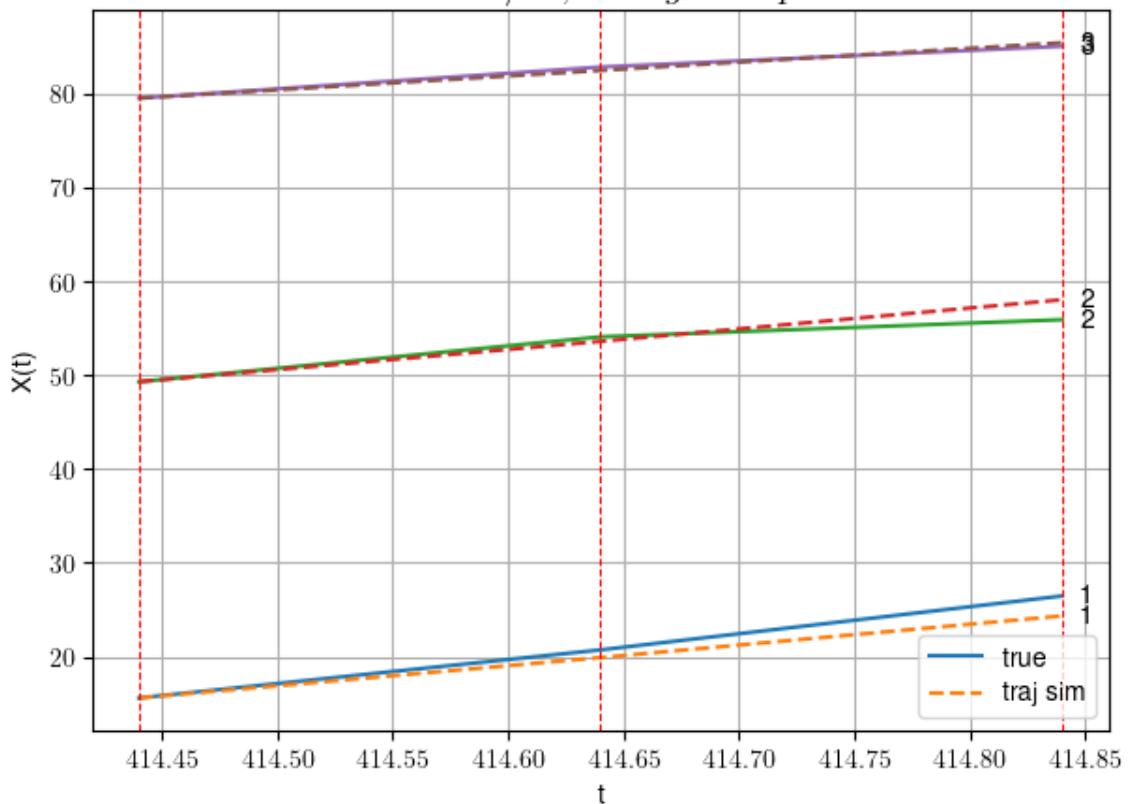
---

Scene n.16/21, time interval:[414.44,414.84]

---

---

Scene n.16/21, using 200 epochs



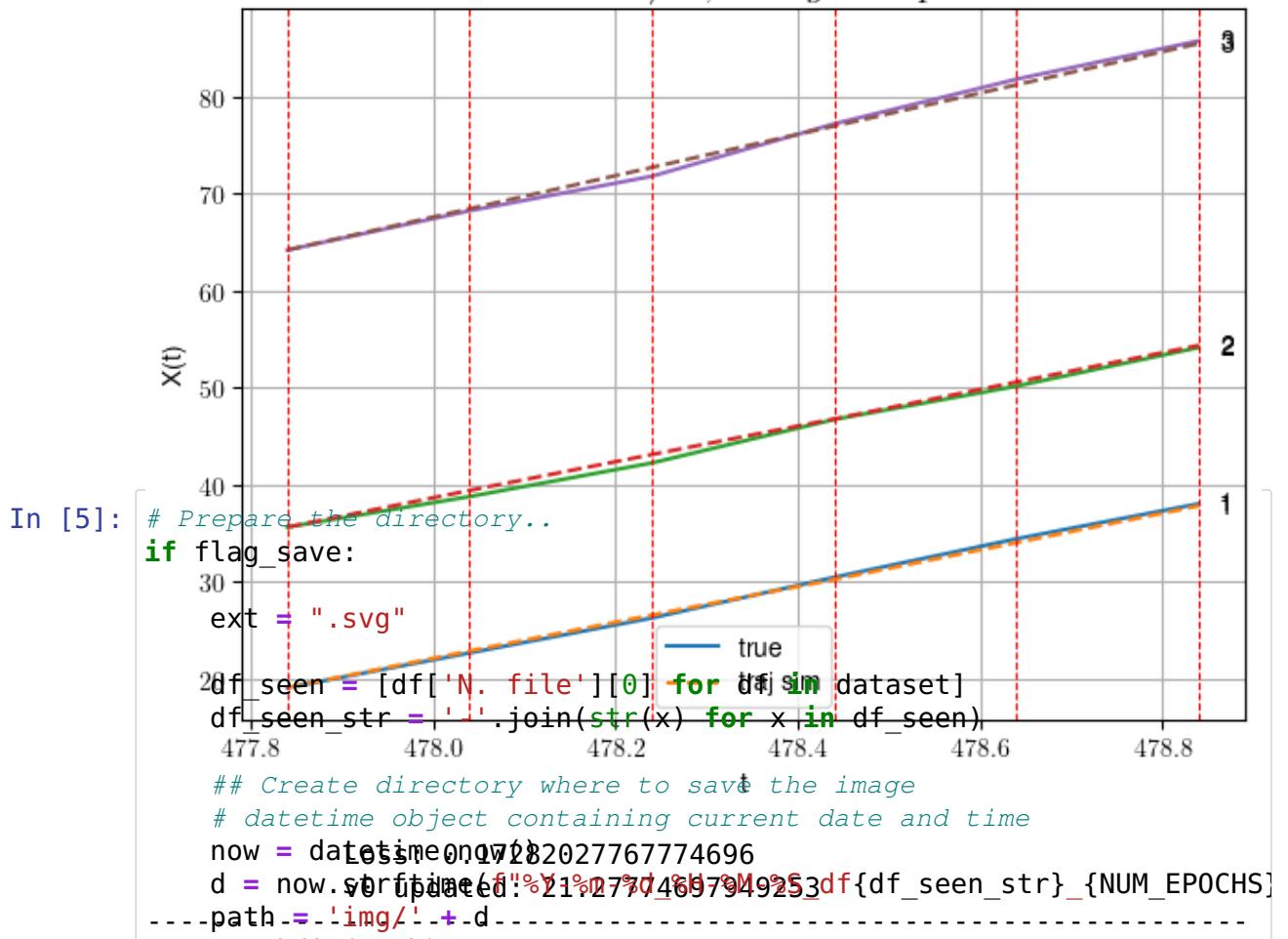
Loss: 1.1329696394391984  
v0 updated: 14.756984069681192

---

Scene n.17/21, time interval:[477.84,478.84]

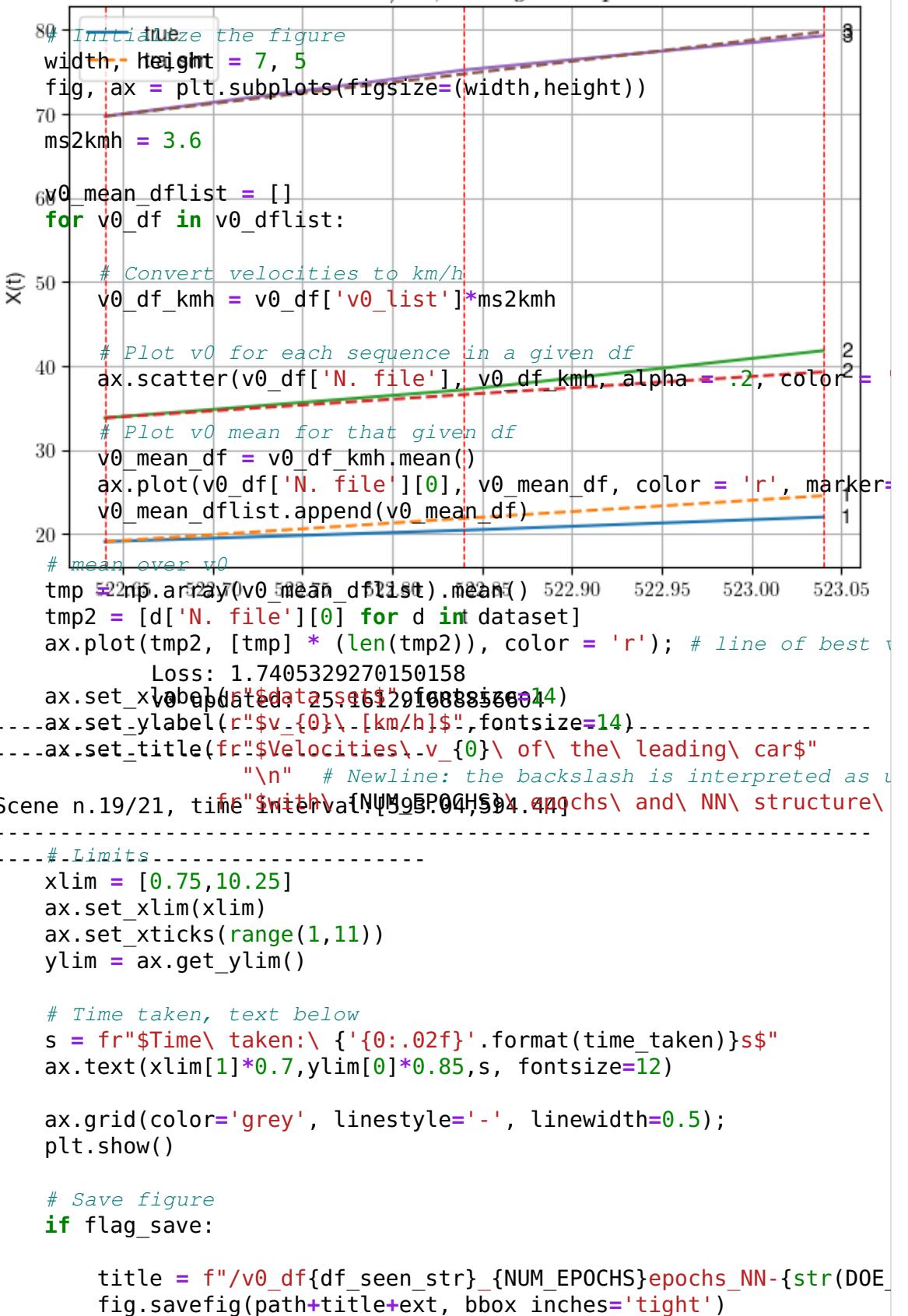
---

## Scene n.17/21, using 200 epochs

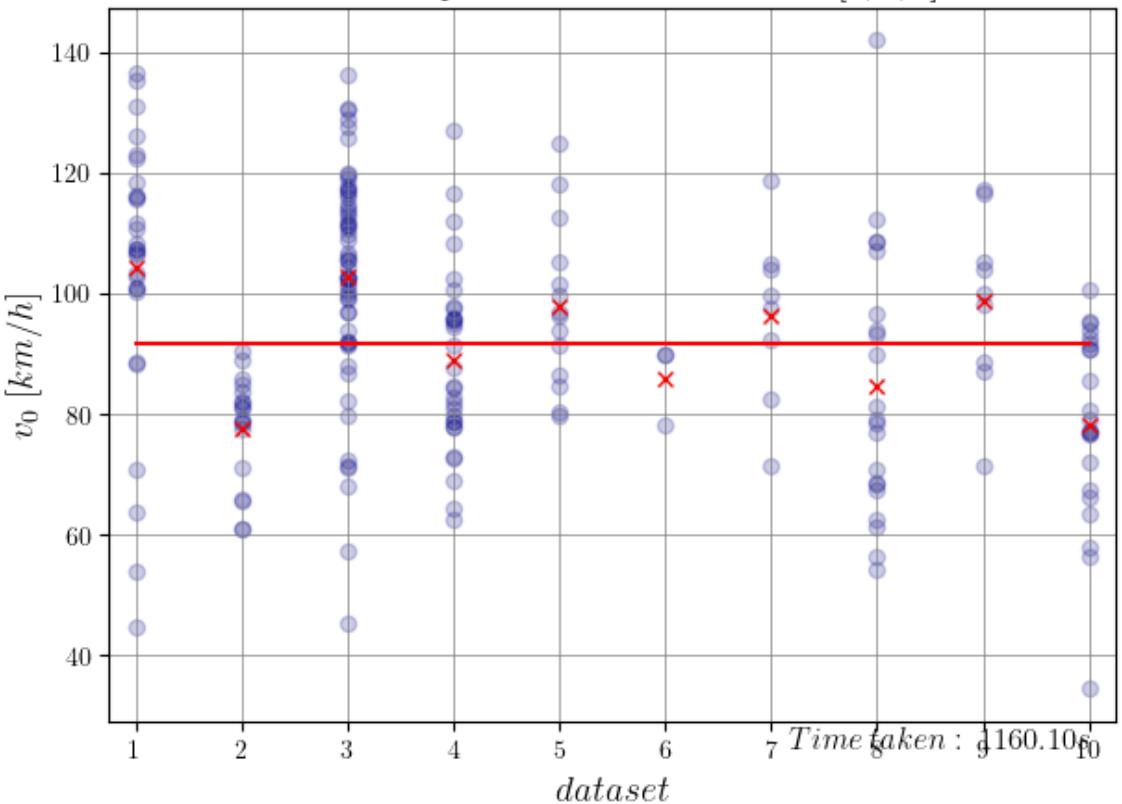


Scene n.18/21, time interval:[522.64,523.04]

In [6]: `for DOE_struct, v0_dflist, time taken in v0 DOE;`

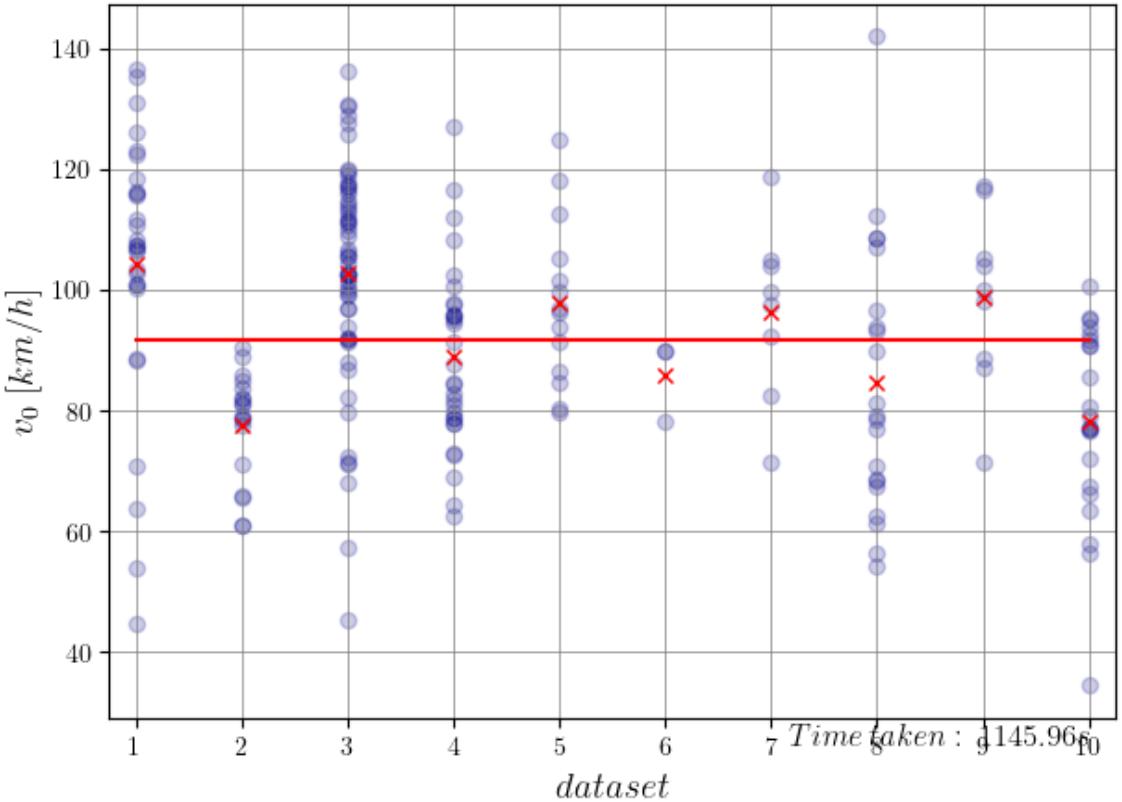


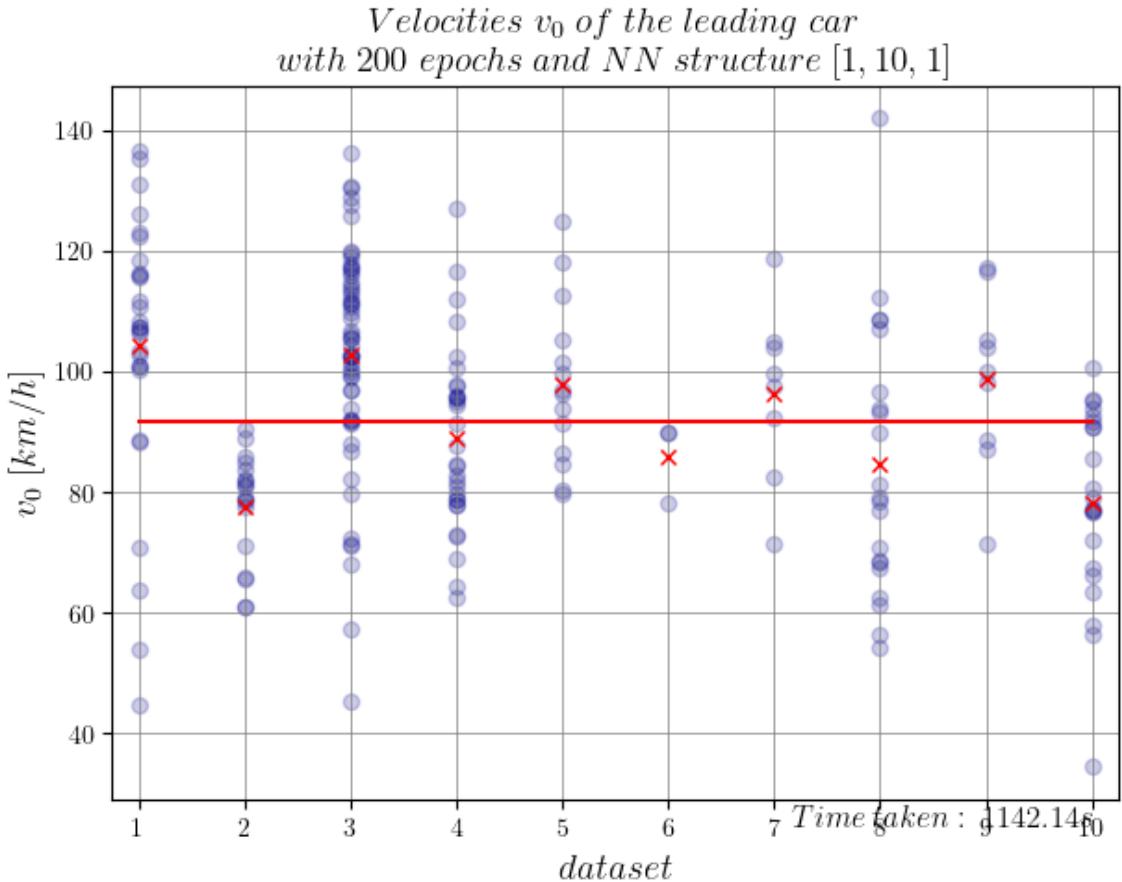
*Velocities  $v_0$  of the leading car  
with 200 epochs and NN structure [1, 2, 1]*



Loss: 4.266746782735732

*Velocities  $v_0$  of the leading car  
with 200 epochs and NN structure [1, 4, 1]*





**Plot together**

```
v0_mean in this df is: 23.488413422860713
Time taken: 120.11s
Hidden-Layer-1/kernel:0:      [-1.0314109e+01 -7.5221496e+00 -1.
2637139e+05 -6.0159552e+02]
Hidden-Layer-1/bias:0:      [ -9.169183      -7.4809117 -6253.4644
-341.692      ]
Output-Layer/kernel:0:      [-1.7986232e+00  4.7162023e+00 -1.5931100
e+05  1.4249943e+01]
Output-Layer/bias:0:      [15.688895]
```

---

In df n.9/10 we have 9 scenes

---

Scene n.0/9, time interval:[5.40, 6.00]

---

In [7]:

```
# define subplot grid Scene n.0/9, using 200 epochs
width, height = 7, 5
nfig = len(v0_DOE)
fig, axes = plt.subplots(nrows=1, ncols=nfig, figsize=(width*nfig, height))
plt.subplots_adjust(hspace=0.4)

suptitle = fr"$Velocities$\ of the leading car, using {NUM_THREADS} threads"
fig.suptitle(suptitle, fontsize=35, y=1.075)

ms2kmh = 3.6

for ax, (DOE_struct, v0_dflist, time_taken) in zip(axes.ravel(), v0_DOE):
    v0_mean_dflist = []
    for v0_df in v0_dflist:
        # Convert velocities to km/h
        v0_df_kmh = v0_df['v0_list'] * ms2kmh
        # Plot v0 for each sequence in a given df
        ax.scatter(v0_df['N. file'], v0_df_kmh, alpha=.2, color='blue')
    # Plot v0 mean for that given df
    v0_mean_df = v0_df_kmh.mean()
    ax.plot(v0_df['N. file'][0], v0_mean_df, color='red', marker='x')
    v0_mean_dflist.append(v0_mean_df)
    Loss: 1.6310264136839192
    v0 updated: 29.082116036814494
    # mean over v0
    tmp = np.array(v0_mean_dflist).mean()
    tmp2 = [d['N. file'][0] for d in dataset]
    ax.plot(tmp2, [tmp] * len(tmp2), color='red'); # line of best fit
Scene n.1/9, time interval:[20.80,21.20]

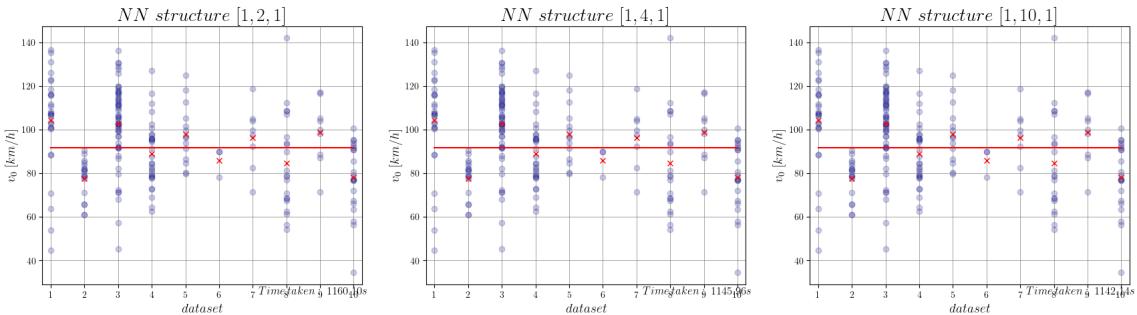
    ax.set_xlabel(r"$data\ set$", fontsize=14)
    ax.set_ylabel(r"$v_{\{0\}}\ [km/h]$".format(0), fontsize=14)
    ax.set_title(fr"$NN\ structure\ \{DOE_struct\}$", fontsize=20)

    # Limits
    xlim = [0.75,10.25]
    ax.set_xlim(xlim)
    ax.set_xticks(range(1,11))
    ylim = ax.get_ylim()

    # Time taken, text below
    s = fr"$Time\ taken:\ \{{0:.02f}\}.format(time_taken)\${\$"
    ax.text(xlim[1]*0.7,ylim[0]*0.85,s, fontsize=12)

    ax.grid(color='grey', linestyle='-', linewidth=0.5);

plt.show()
```

*Velocities  $v_0$  of the leading car, using 200 epochs*

In [8]:

```
#(X) Save figure
if flag_save:
    title = f"/v0_df{df_seen_str}_{NUM_EPOCHS}epochs_NN-ALL"
    fig.savefig(path+title+ext, bbox_inches='tight')
```

A line graph showing the mean velocity  $v_0$  in km/h on the y-axis (ranging from 40 to 60) against time taken in seconds on the x-axis (ranging from 20.80 to 21.20). Three data series are plotted: a solid blue line, a dashed green line, and a dash-dotted orange line. All three series show an upward trend, indicating that the mean velocity increases over time. Vertical red dashed lines are drawn at approximately 20.80, 21.00, and 21.20 seconds.

















































































































































































































































































































































































































































































