Ideal Nozzle Simulation Inputs:

a: 0.05 meter ** 2 / kilogram
n: 0.65
m: -0.2

Oxidiser:

Initial Volume: 0.41 liter
Initial Mass: 0.68 lbs

Injector Mass Flow Rate: 0.026 kilogram / second
Number of Injectors: 1
Ideal O/F Ratio: 4.83
External Temp: 70 degF
Time Step: 0.01 second

Simulation Results:

Total Burn Time: 11.76 second

Impulse: 1197.85 newton * second
Average Thrust: 101.86 newton
Motor: J102

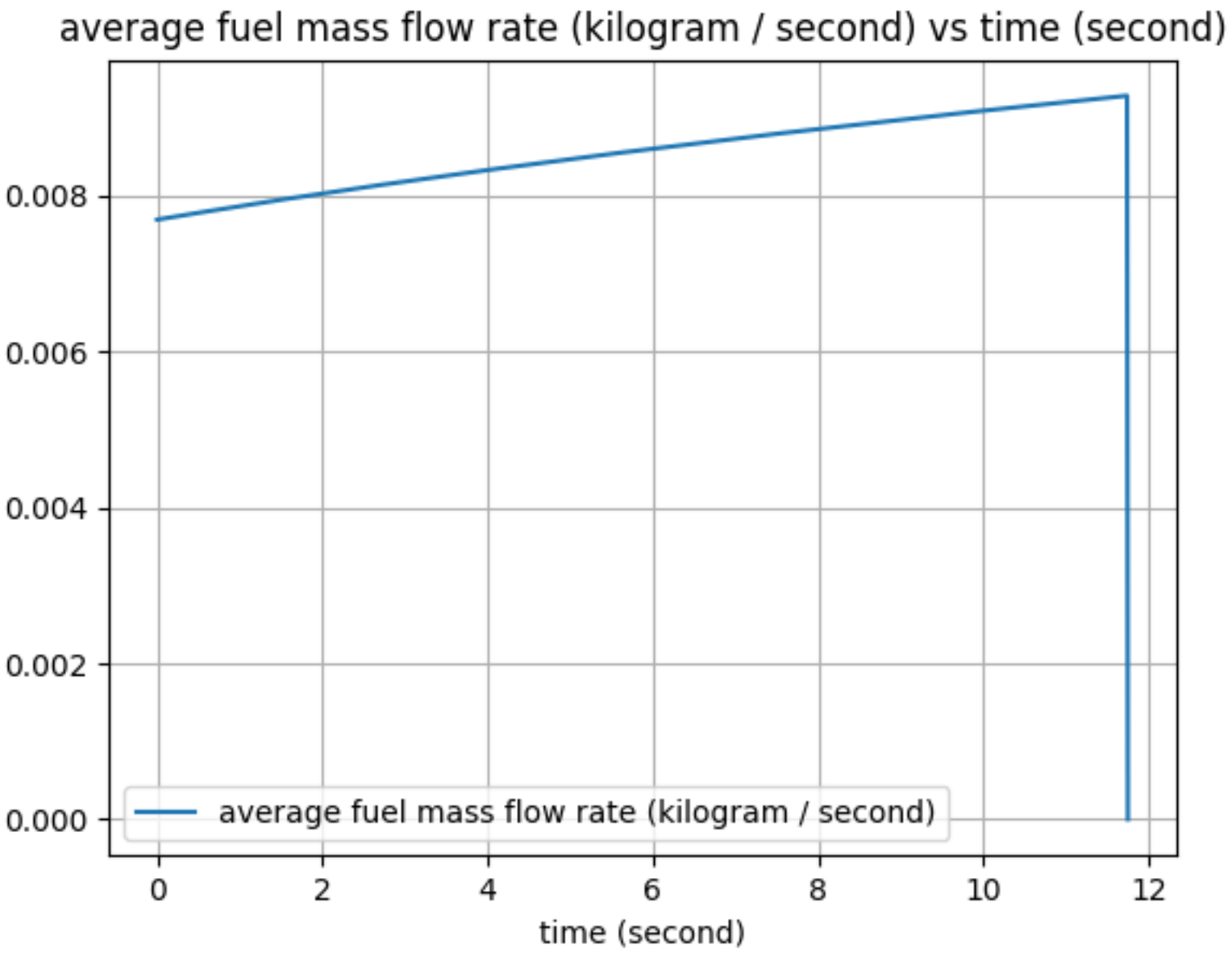
Nozzle Results:

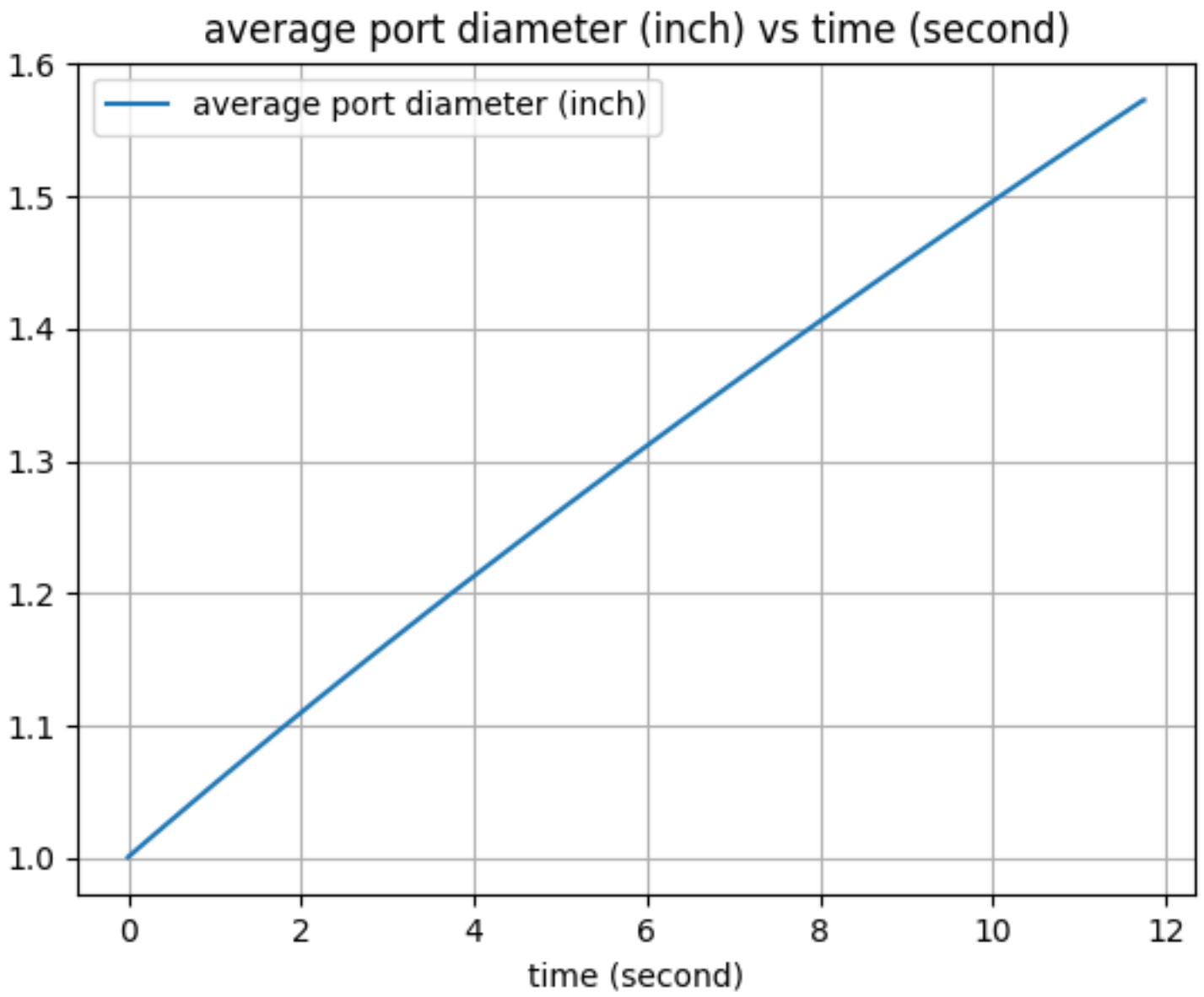
Suggested Throat Diameter: 0.169 inch
Suggested Exit Diameter: 0.383 inch
Suggested Diffuser Length: 0.4 inch

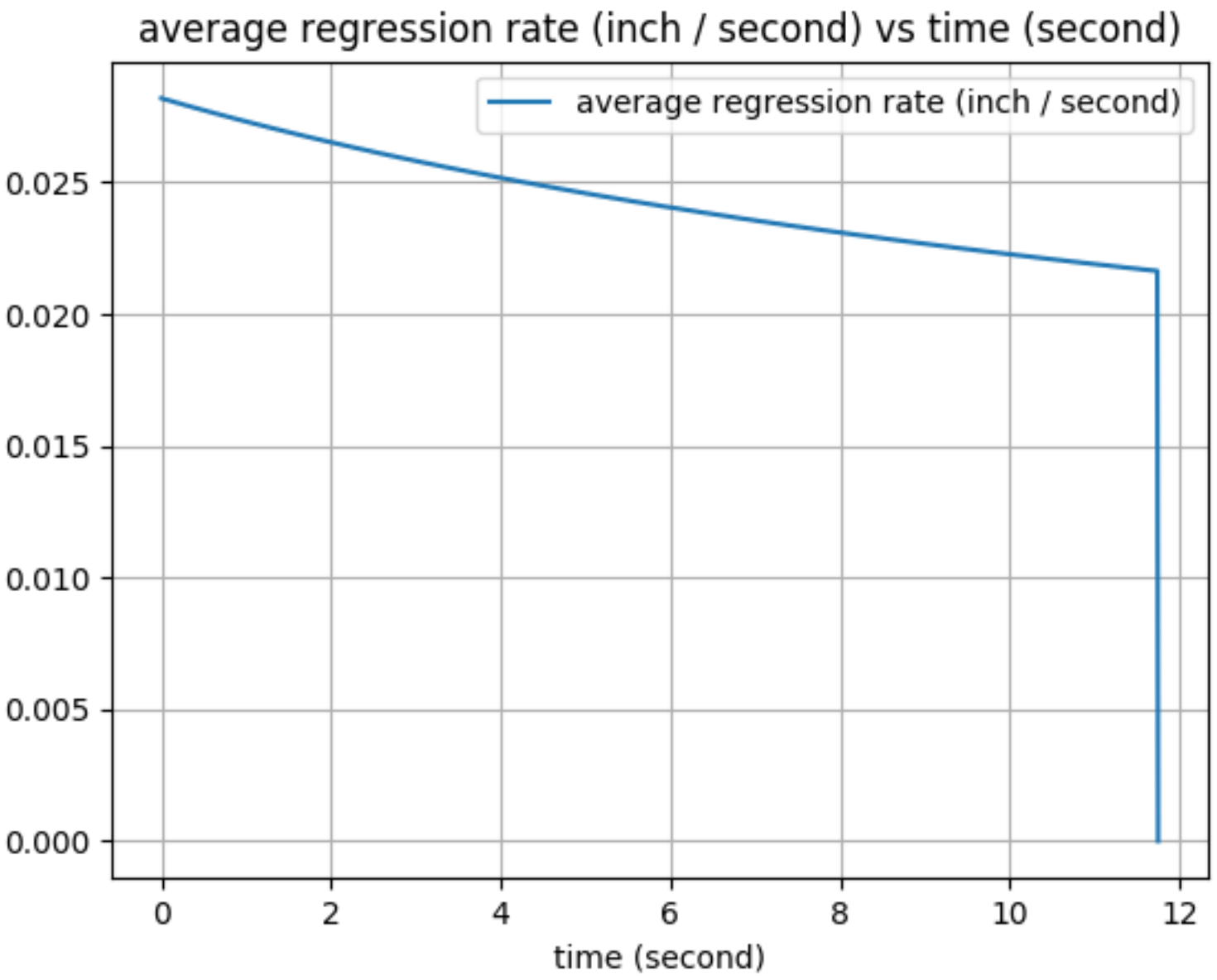
Fuel Grain

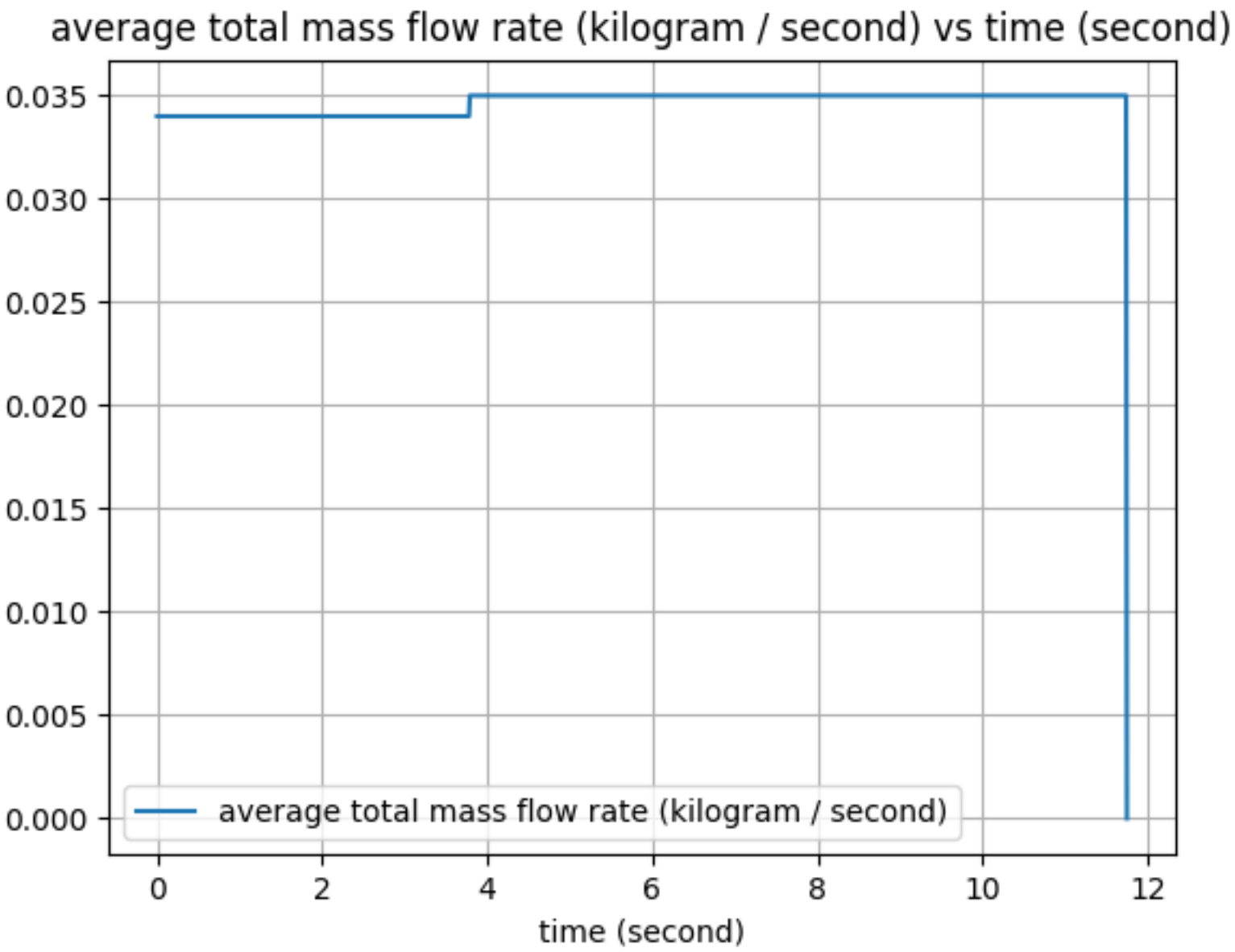
Port Length: 13.4 inch
Fuel Density: 3.96 kilogram / meter ** 3

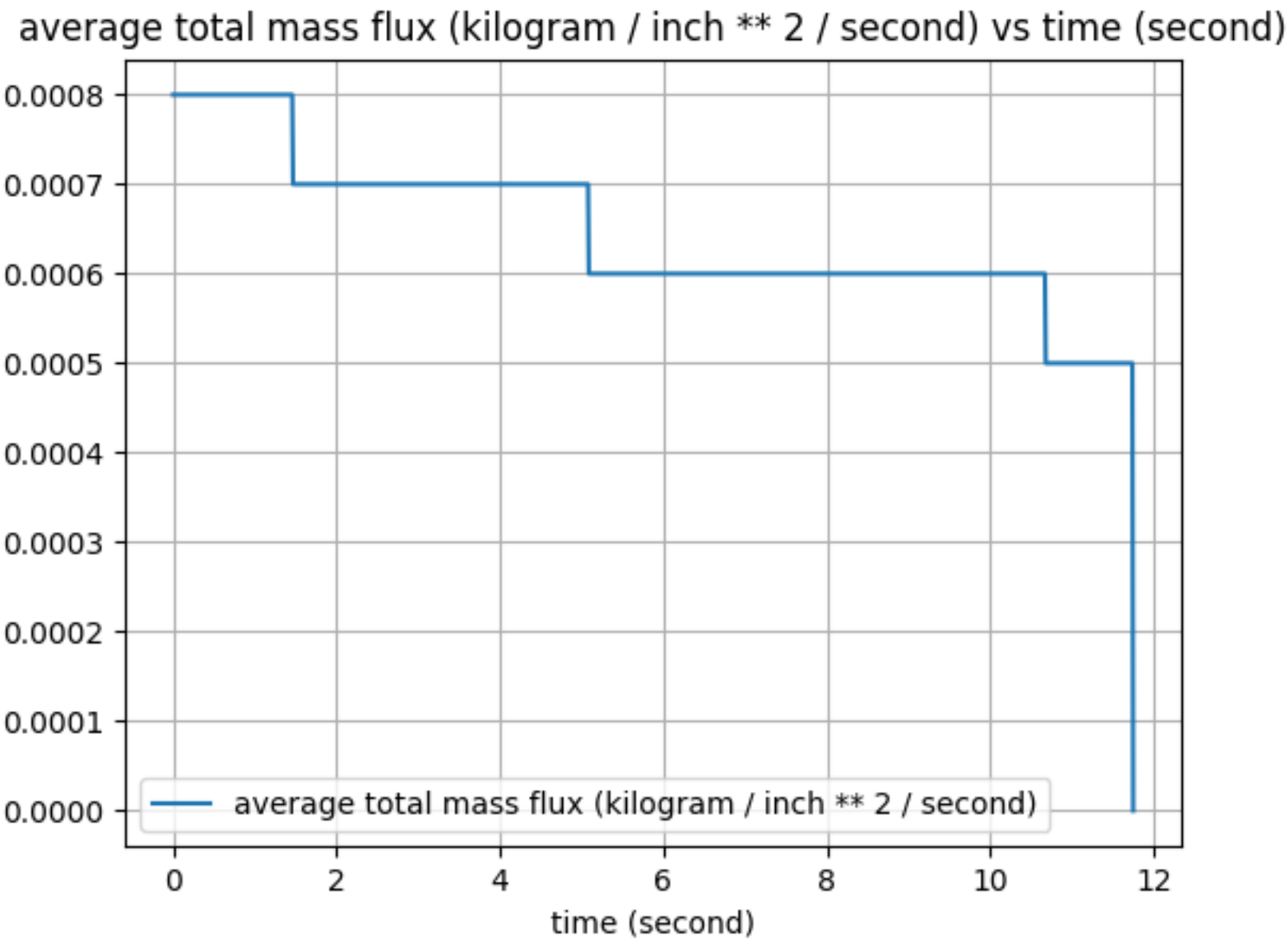
Grain Diameter: 1.75 inch
Initial Port Diameter: 1.0 inch
Final Port Diameter: 1.573 inch

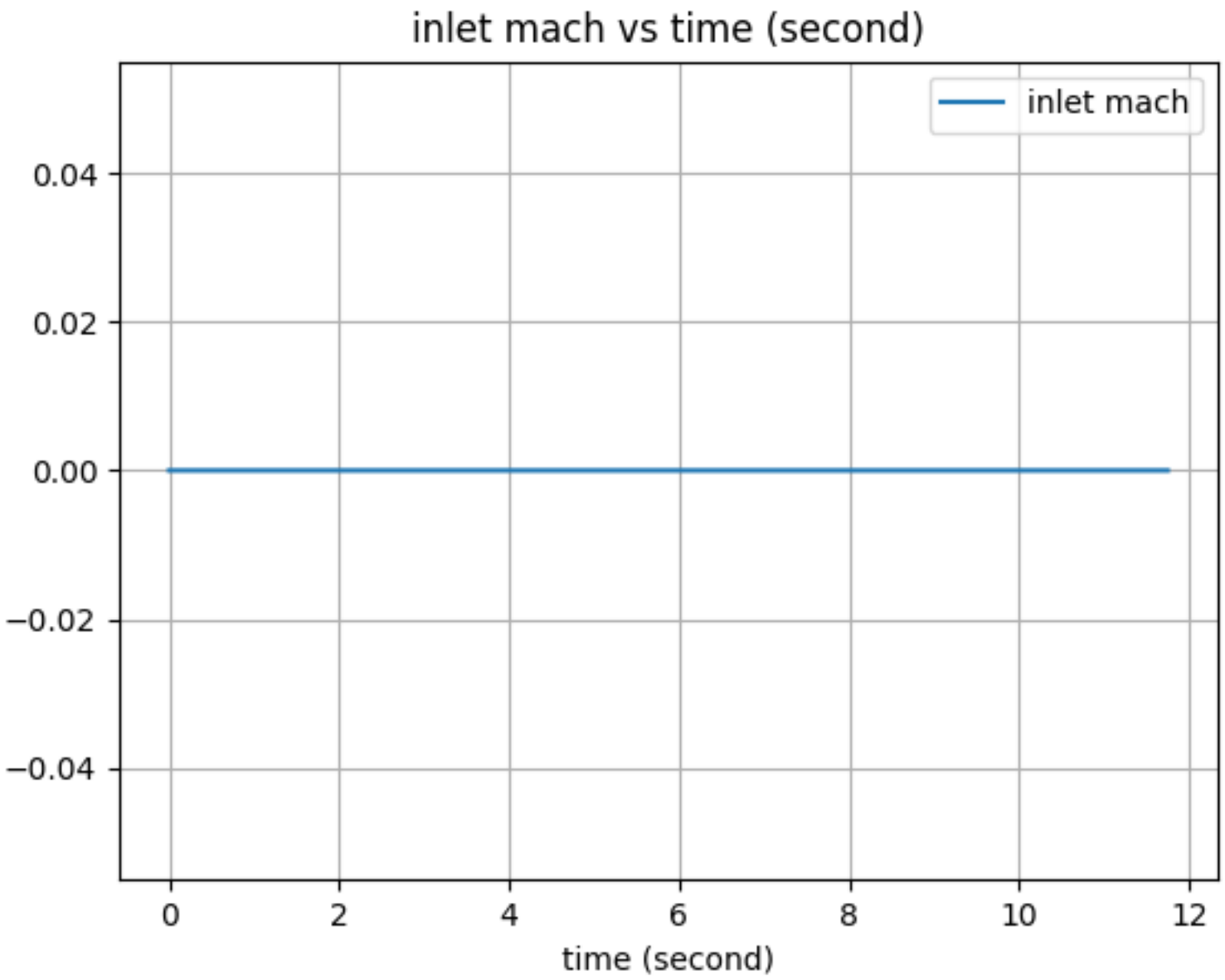

average fuel mass flow rate (kilogram / second) vs time (second)
0.008
0.006
0.004
0.002
0.000
average fuel mass flow rate (kilogram / second)
0
2
4
6
8
10
12
time (second)

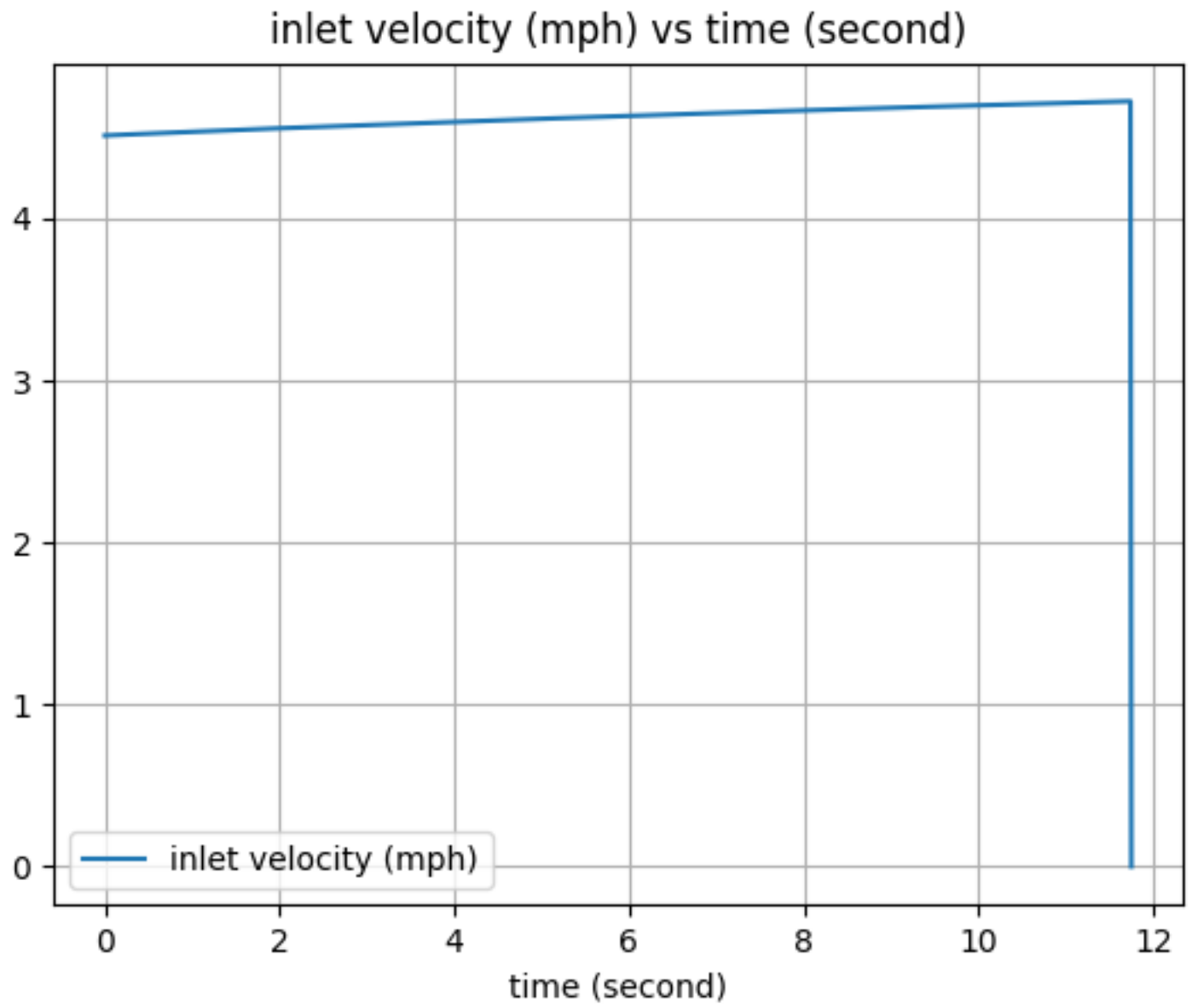

average port diameter (inch) vs time (second)
average port diameter (inch)
1.6
1.5
1.4
1.3
1.2
1.1
1.0
0
2
4
6
8
10
12
time (second)

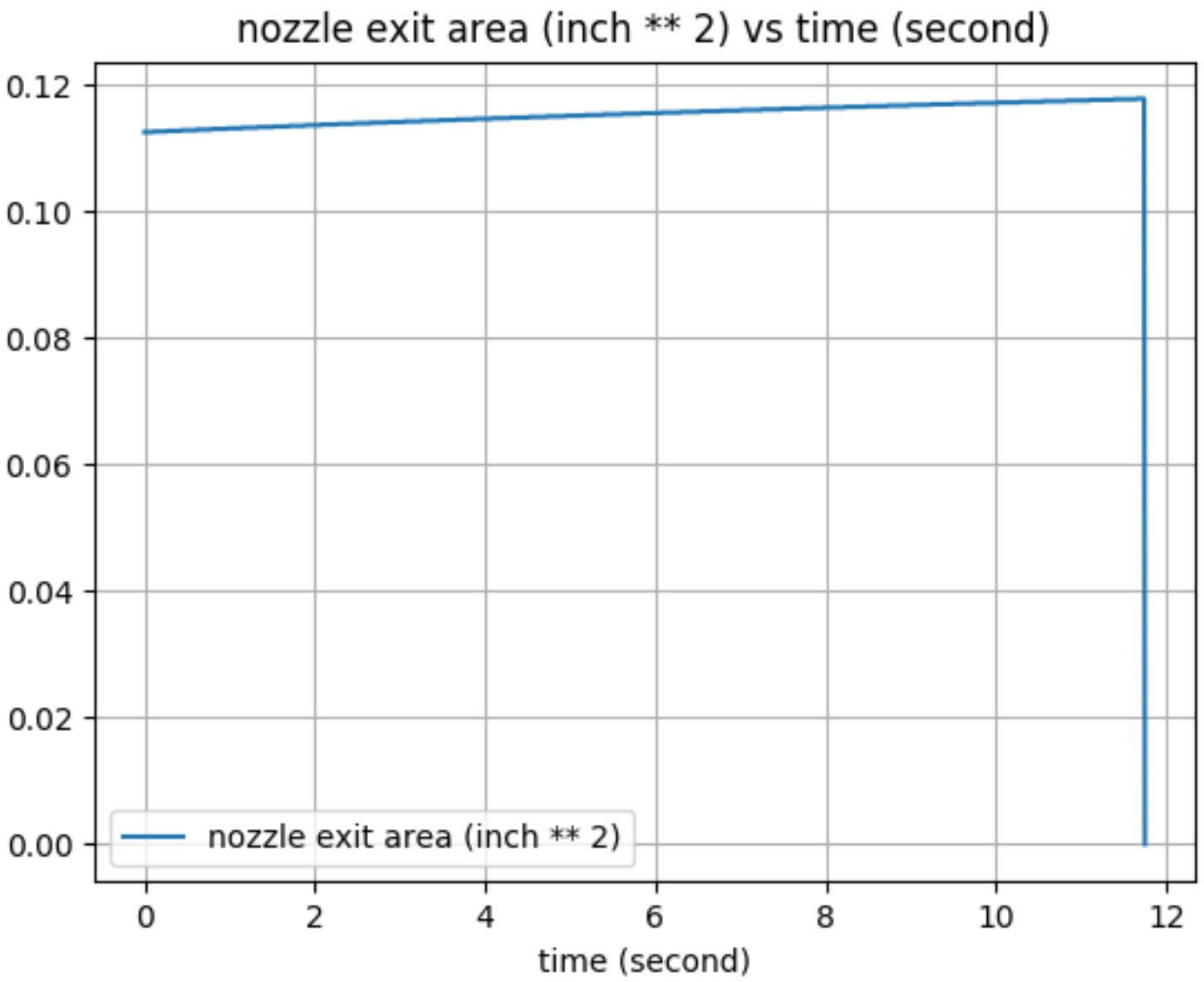

average regression rate (inch / second) vs time (second)
average regression rate (inch / second)
0.025
0.020
0.015
0.010
0.005
0.000
0
2
4
6
8
10
12
time (second)

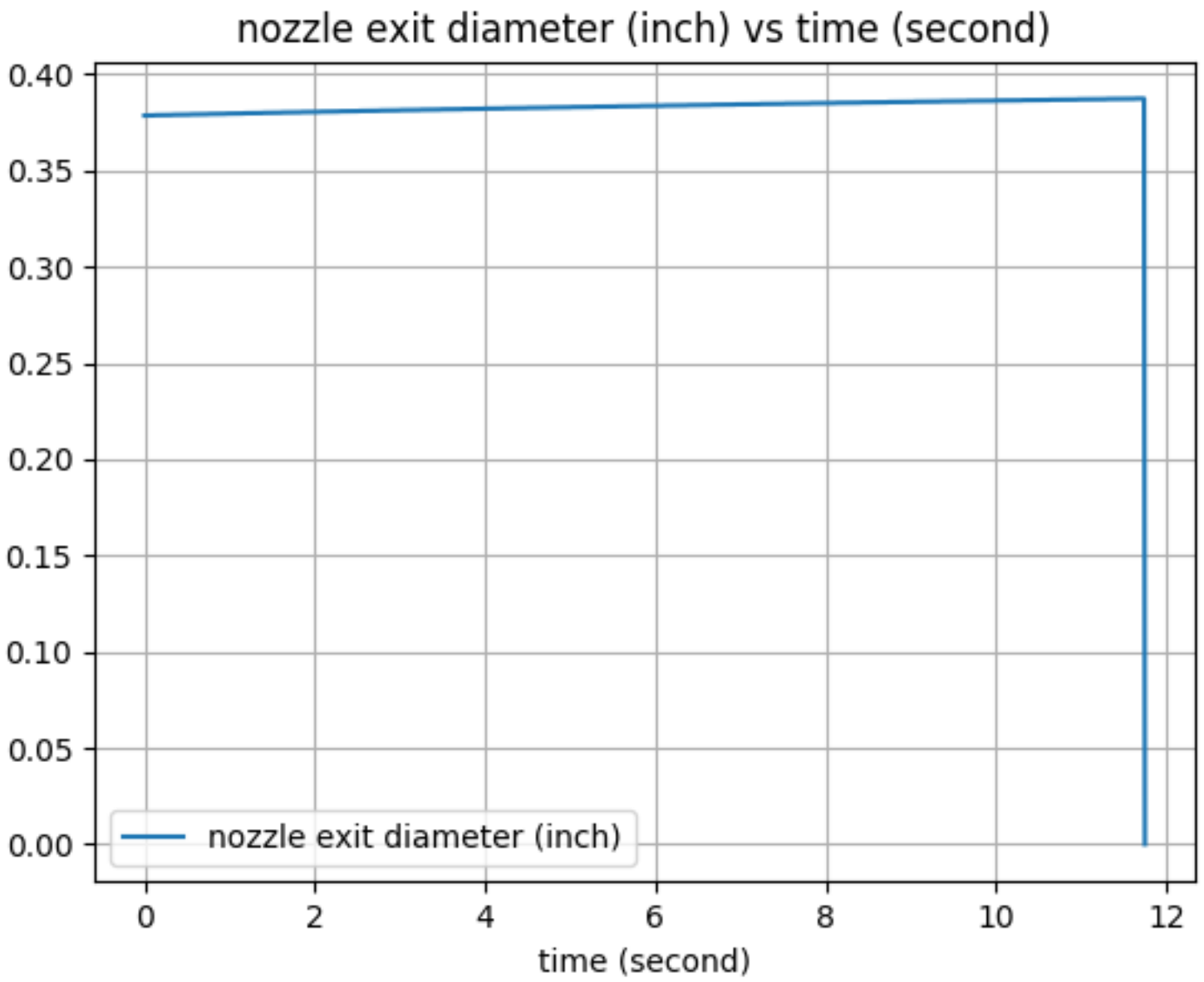

average total mass flow rate (kilogram / second) vs time (second)
0.035
0.030
0.025
0.020
0.015
0.010
0.005
0.000
average total mass flow rate (kilogram / second)
0
2
4
6
8
10
12
time (second)

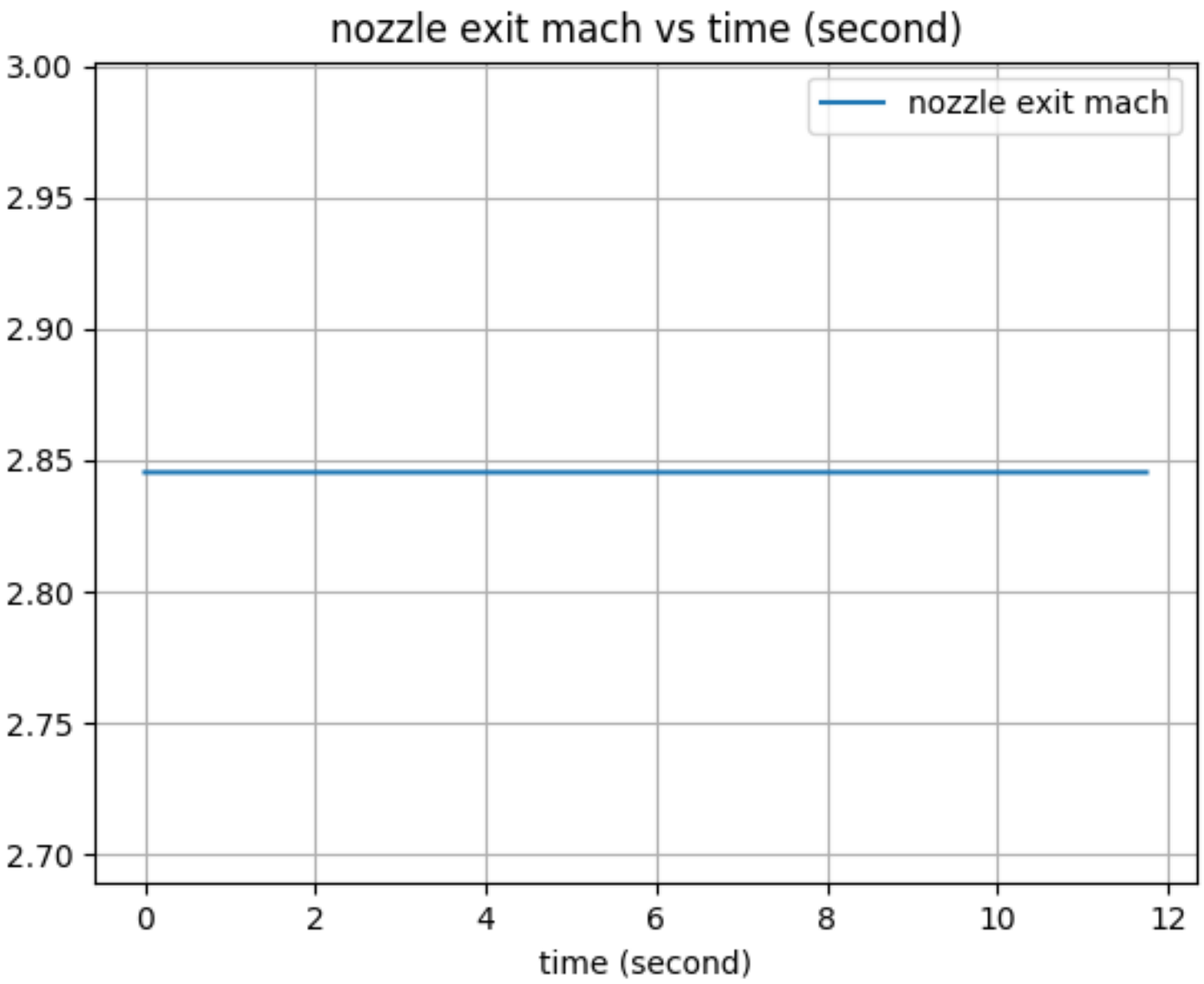

average total mass flux (kilogram / inch ** 2 / second) vs time (second)
0.0008
0.0007
0.0006
0.0005
0.0004
0.0003
0.0002
0.0001
0.0000
average total mass flux (kilogram / inch ** 2 / second)
0
2
4
6
8
10
12
time (second)

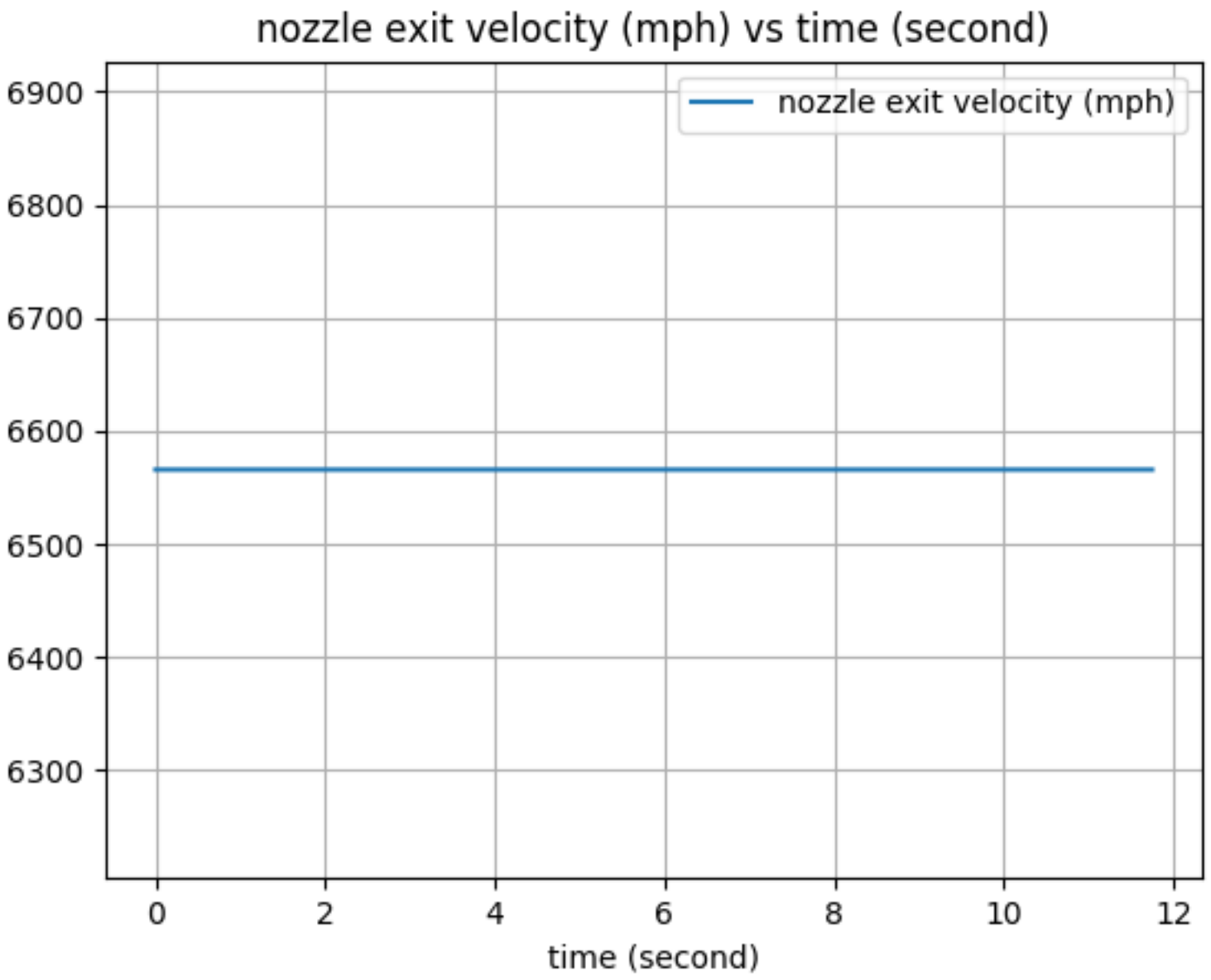

inlet mach vs time (second)
inlet mach
0.04
0.02
0.00
−0.02
−0.04
0
2
4
6
8
10
12
time (second)

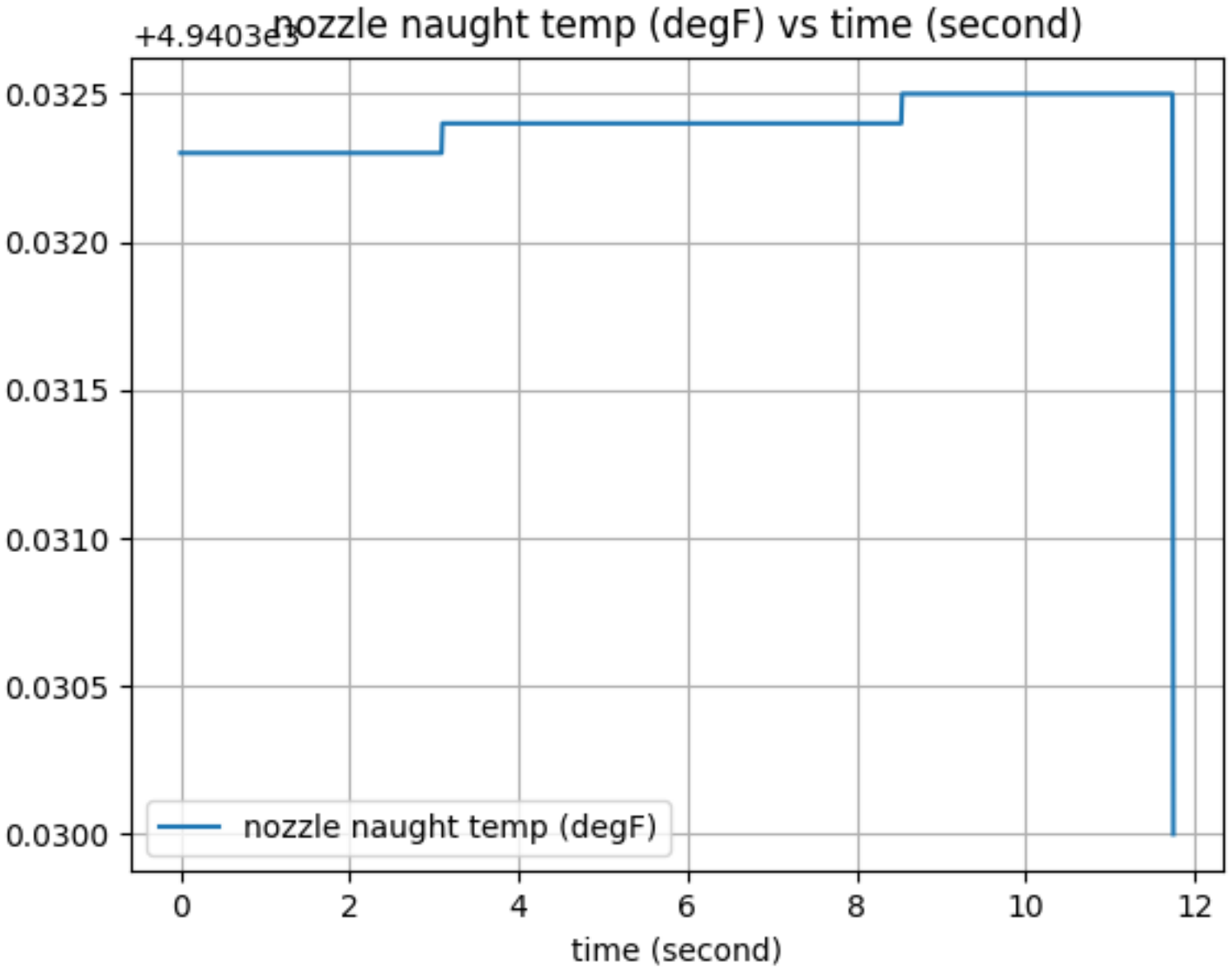

inlet velocity (mph) vs time (second)
4
3
2
1
0
inlet velocity (mph)
0
2
4
6
8
10
12
time (second)

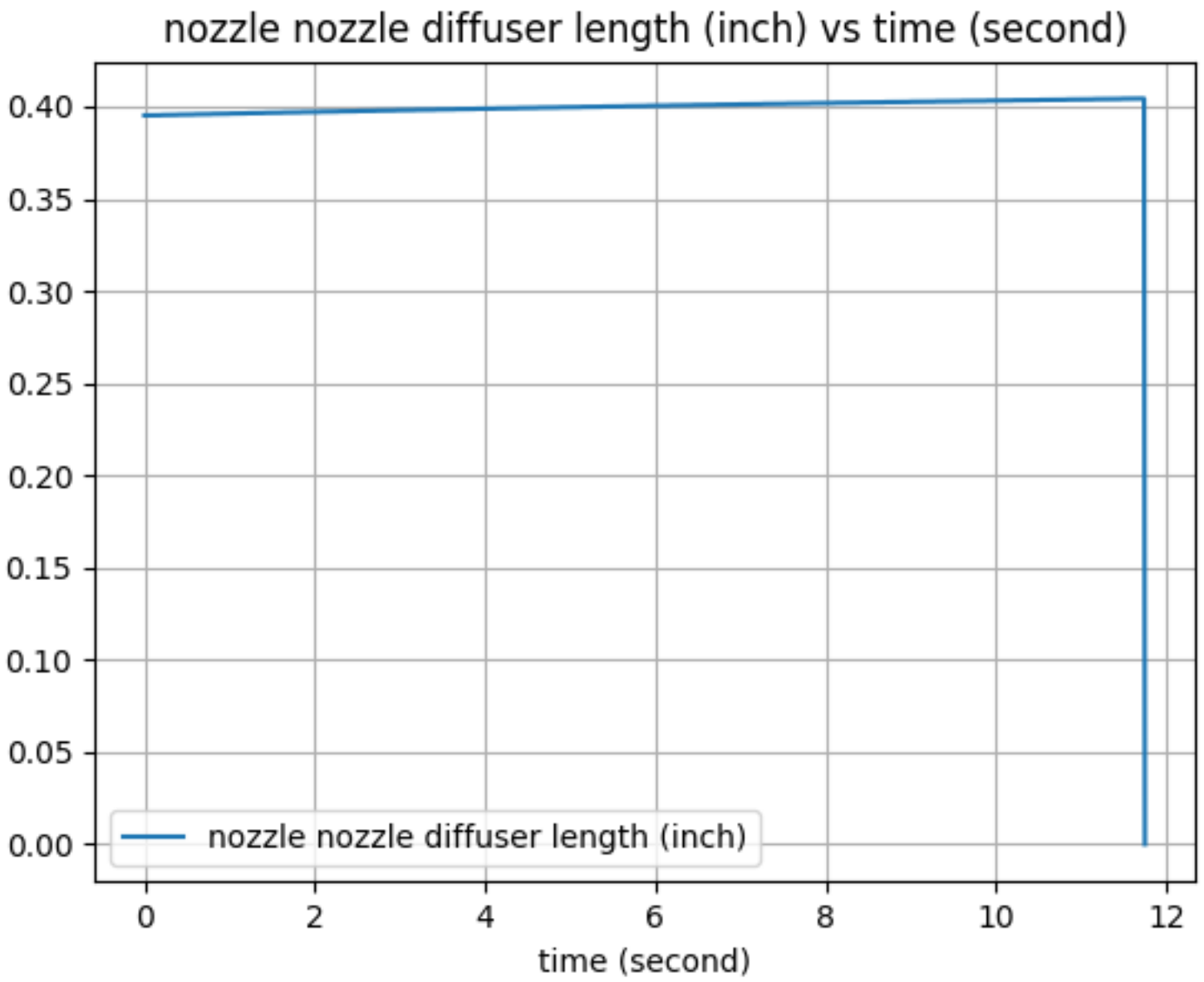

nozzle exit area (inch ** 2) vs time (second)
0.12
0.10
0.08
0.06
0.04
0.02
0.00
nozzle exit area (inch ** 2)
0
2
4
6
8
10
12
time (second)

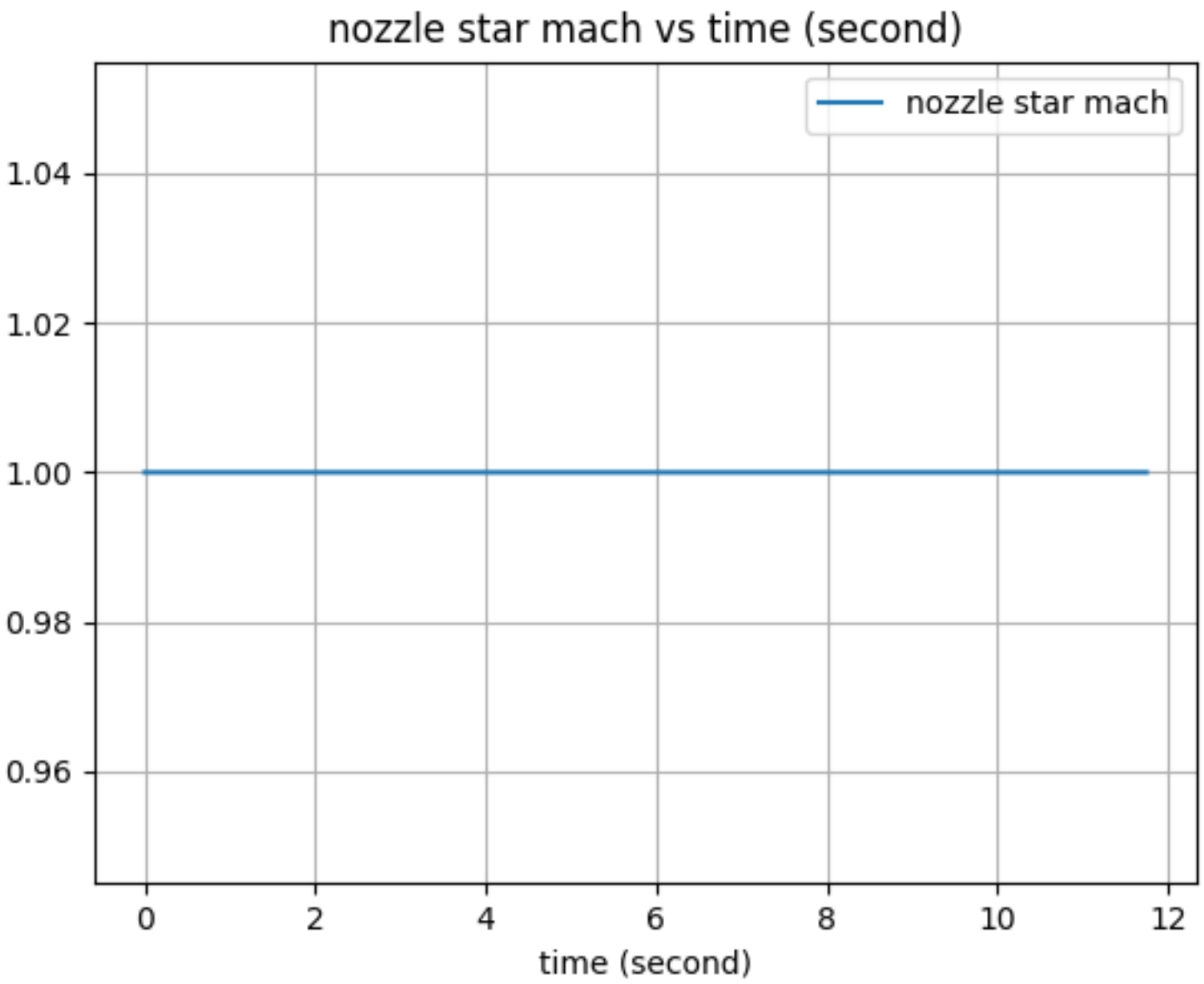

nozzle exit diameter (inch) vs time (second)
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
nozzle exit diameter (inch)
0
2
4
6
8
10
12
time (second)

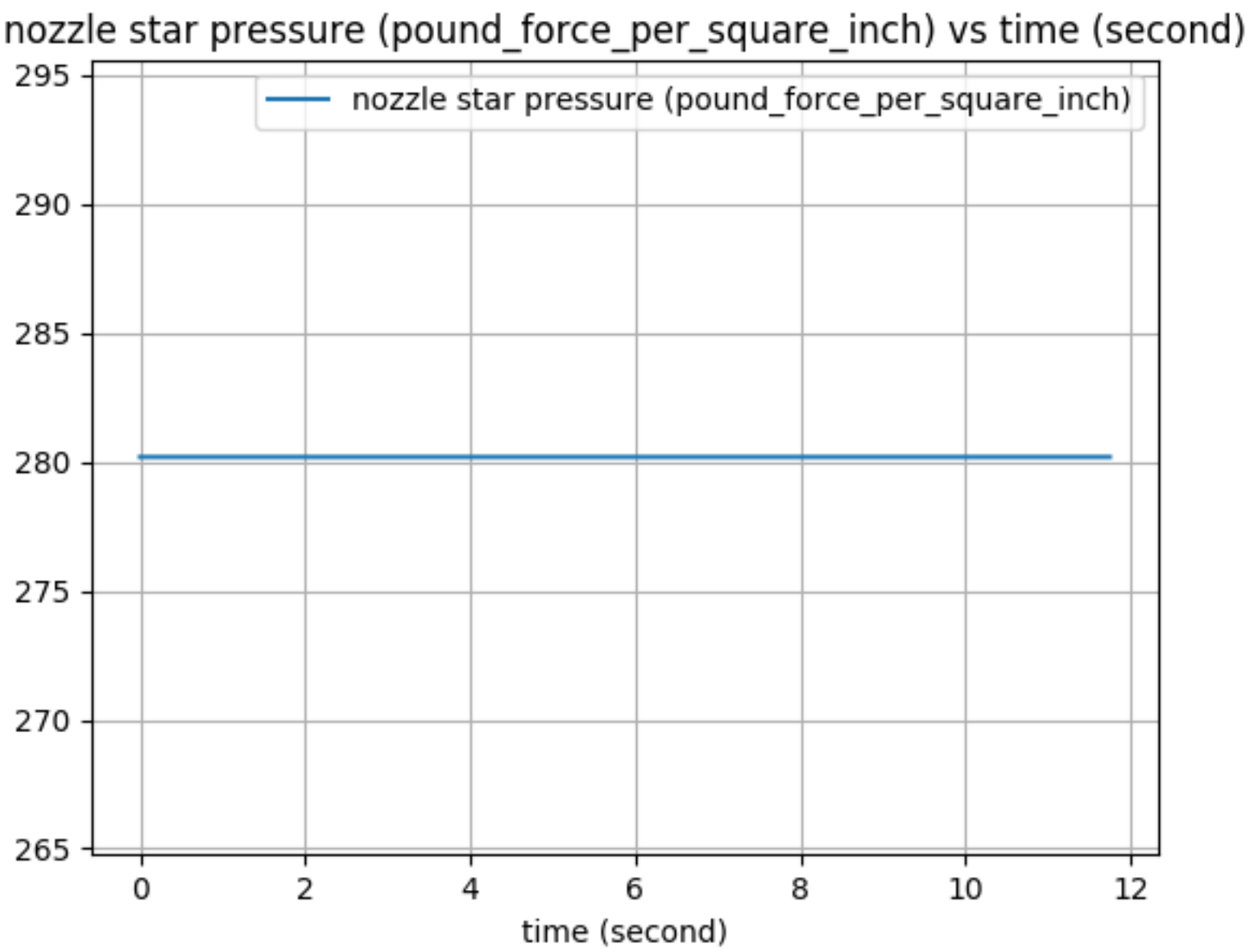

nozzle exit mach vs time (second)
nozzle exit mach
3.00
2.95
2.90
2.85
2.80
2.75
2.70
0
2
4
6
8
10
12
time (second)

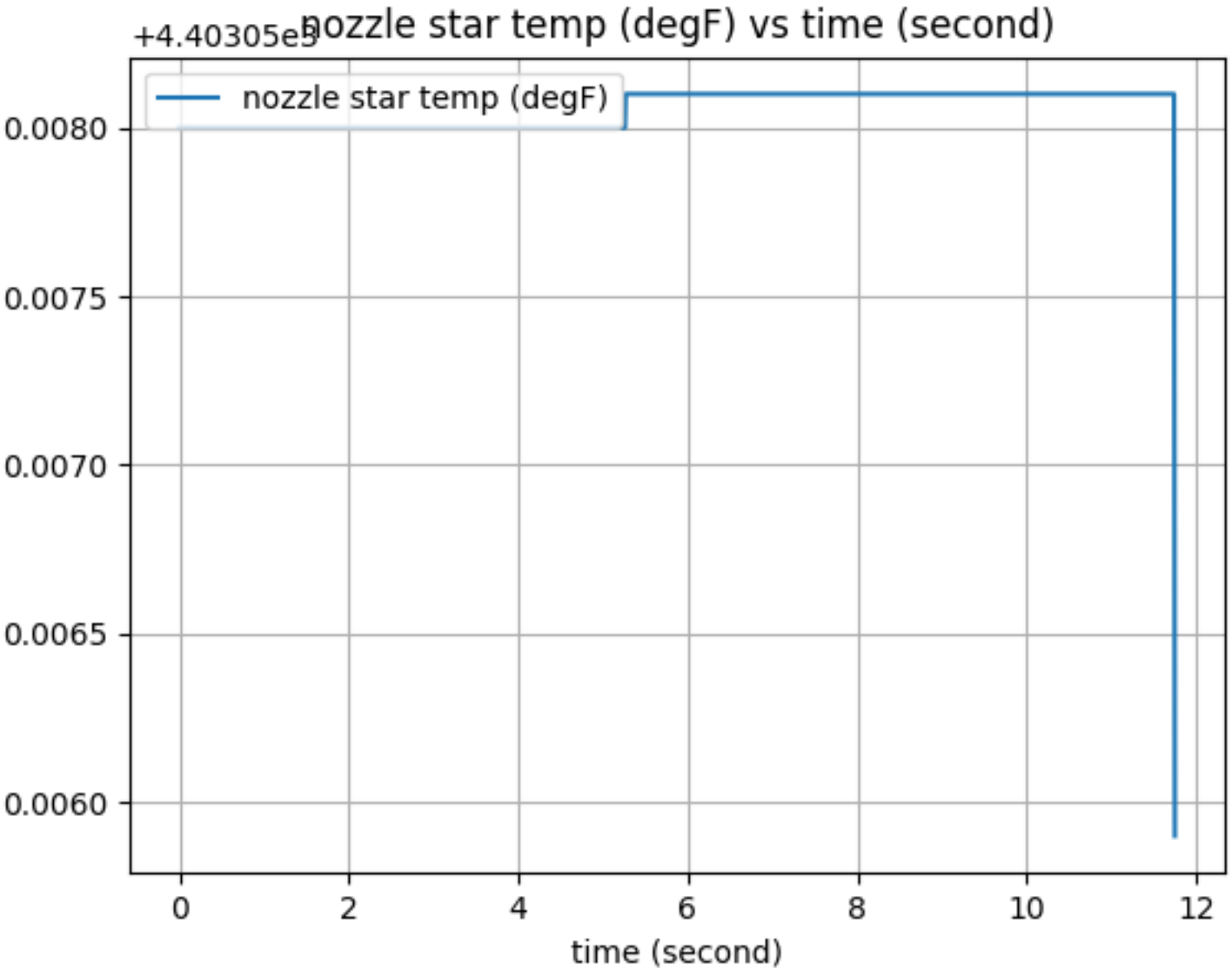

nozzle exit velocity (mph) vs time (second)
nozzle exit velocity (mph)
6900
6800
6700
6600
6500
6400
6300
0
2
4
6
8
10
12
time (second)

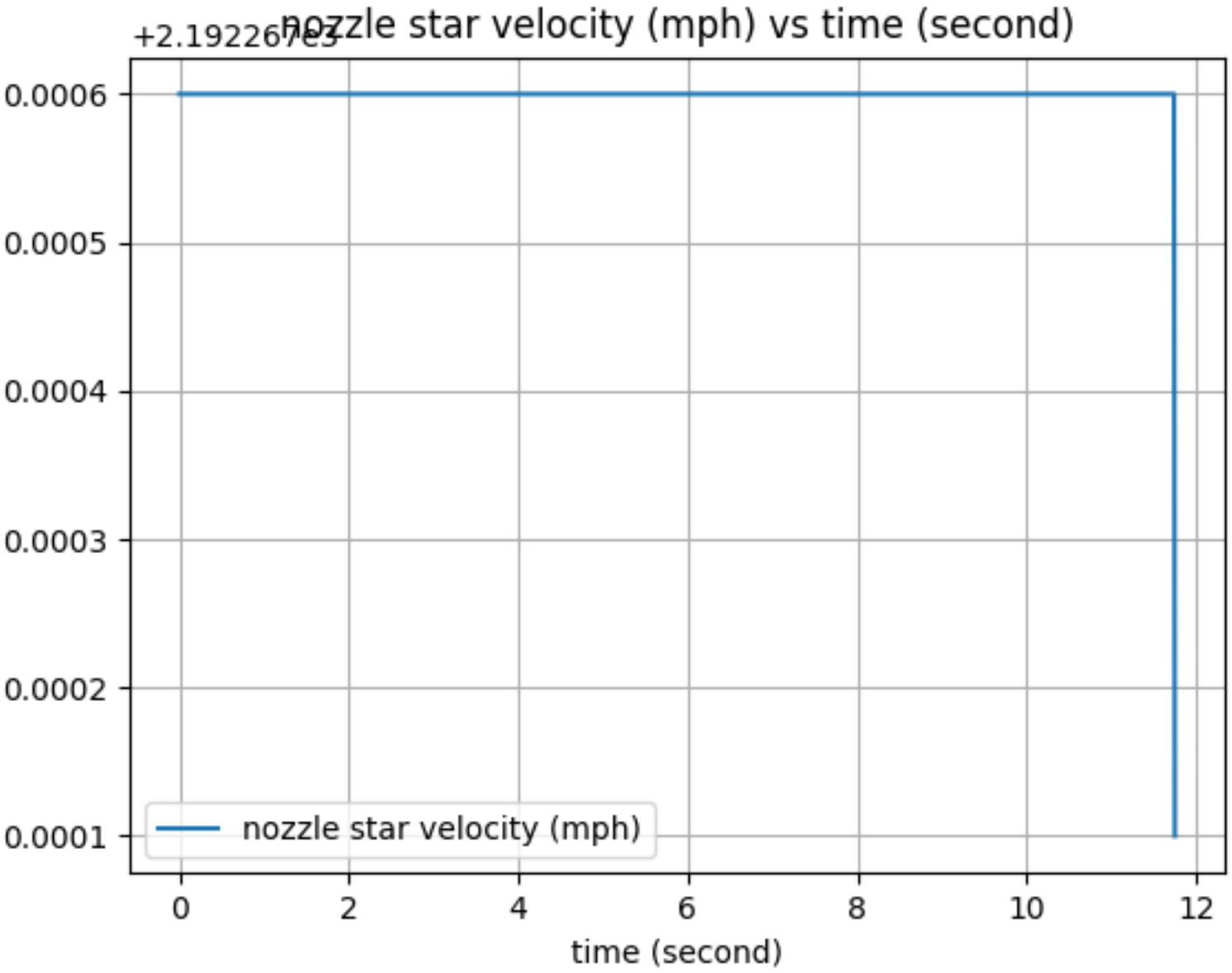

nozzle naught temp (degF) vs time (second)
+4.9403e3
0.0325
0.0320
0.0315
0.0310
0.0305
0.0300
nozzle naught temp (degF)
0
2
4
6
8
10
12
time (second)

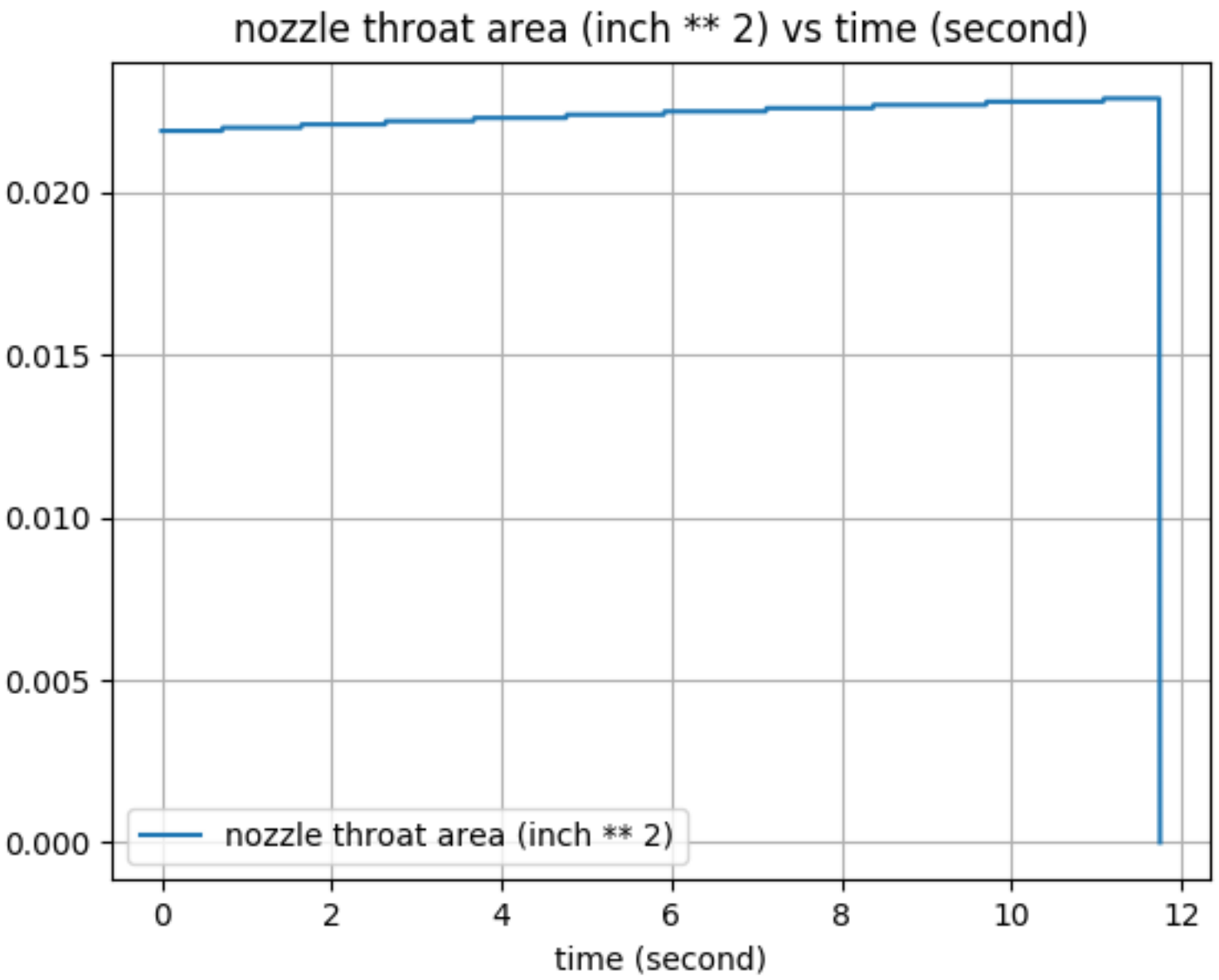

nozzle nozzle diffuser length (inch) vs time (second)
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
nozzle nozzle diffuser length (inch)
0
2
4
6
8
10
12
time (second)

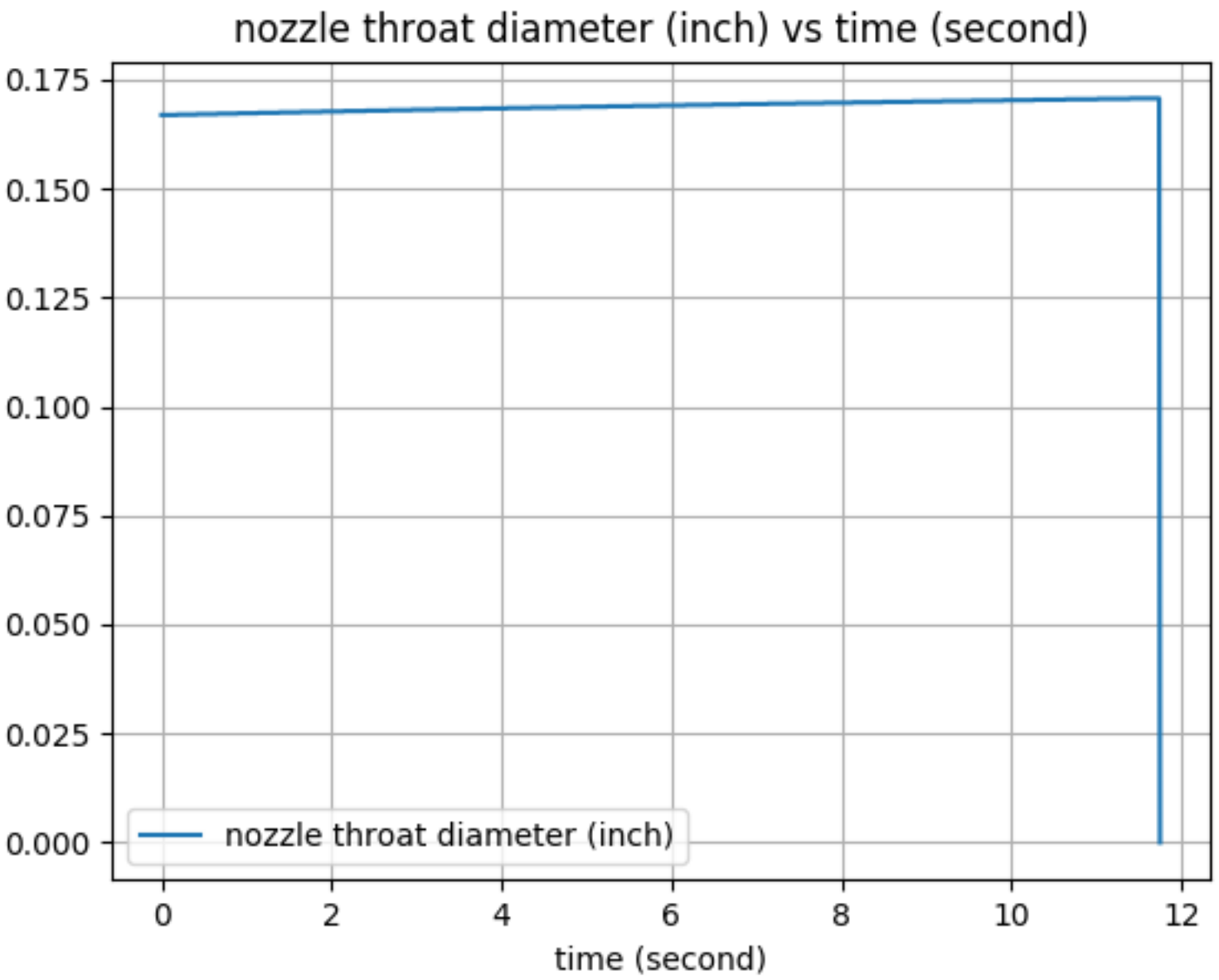

nozzle star mach vs time (second)
nozzle star mach
1.04
1.02
1.00
0.98
0.96
0
2
4
6
8
10
12
time (second)

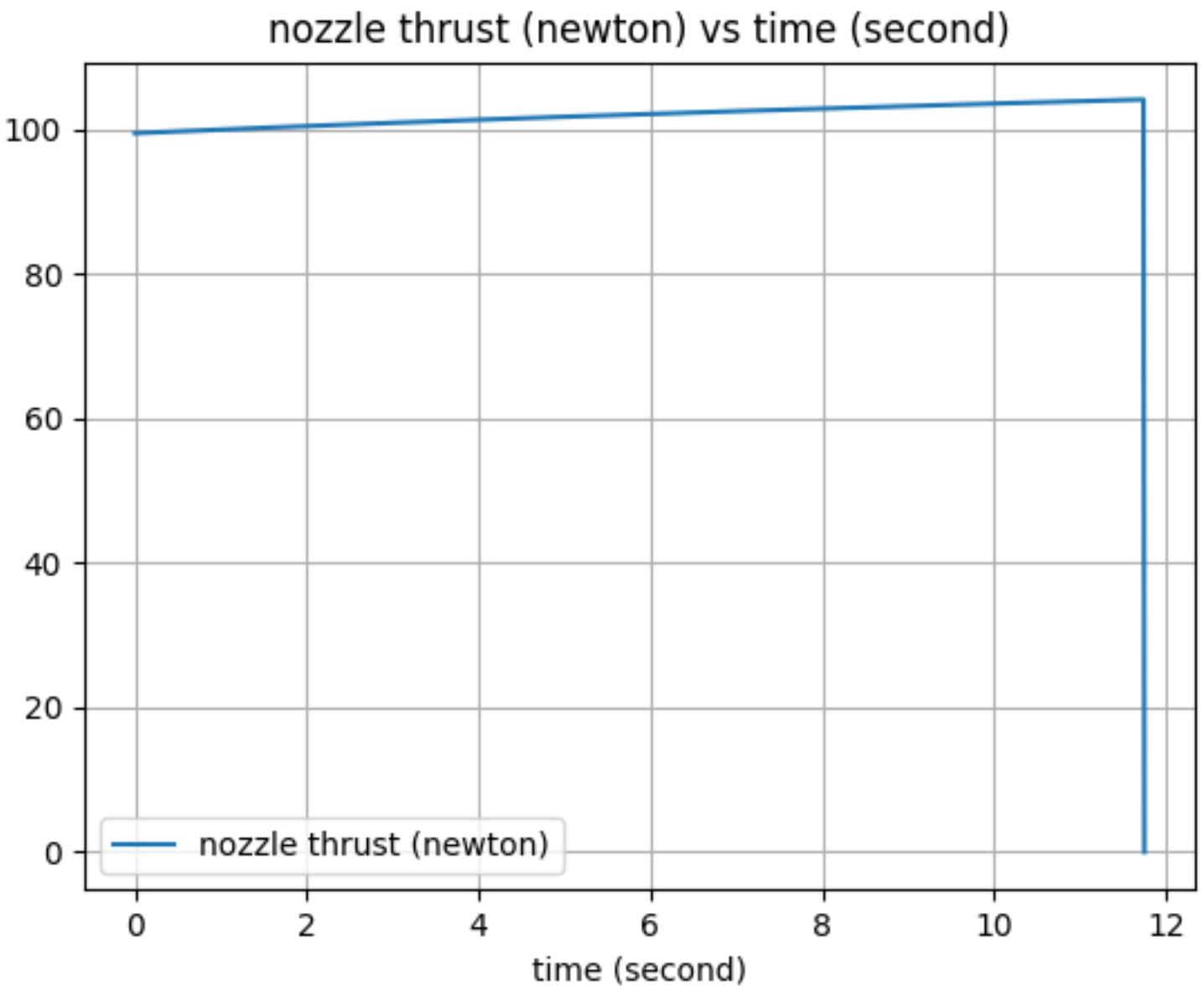

nozzle star pressure (pound_force_per_square_inch) vs time (second)
nozzle star pressure (pound_force_per_square_inch)
295
290
285
280
275
270
265
0
2
4
6
8
10
12
time (second)

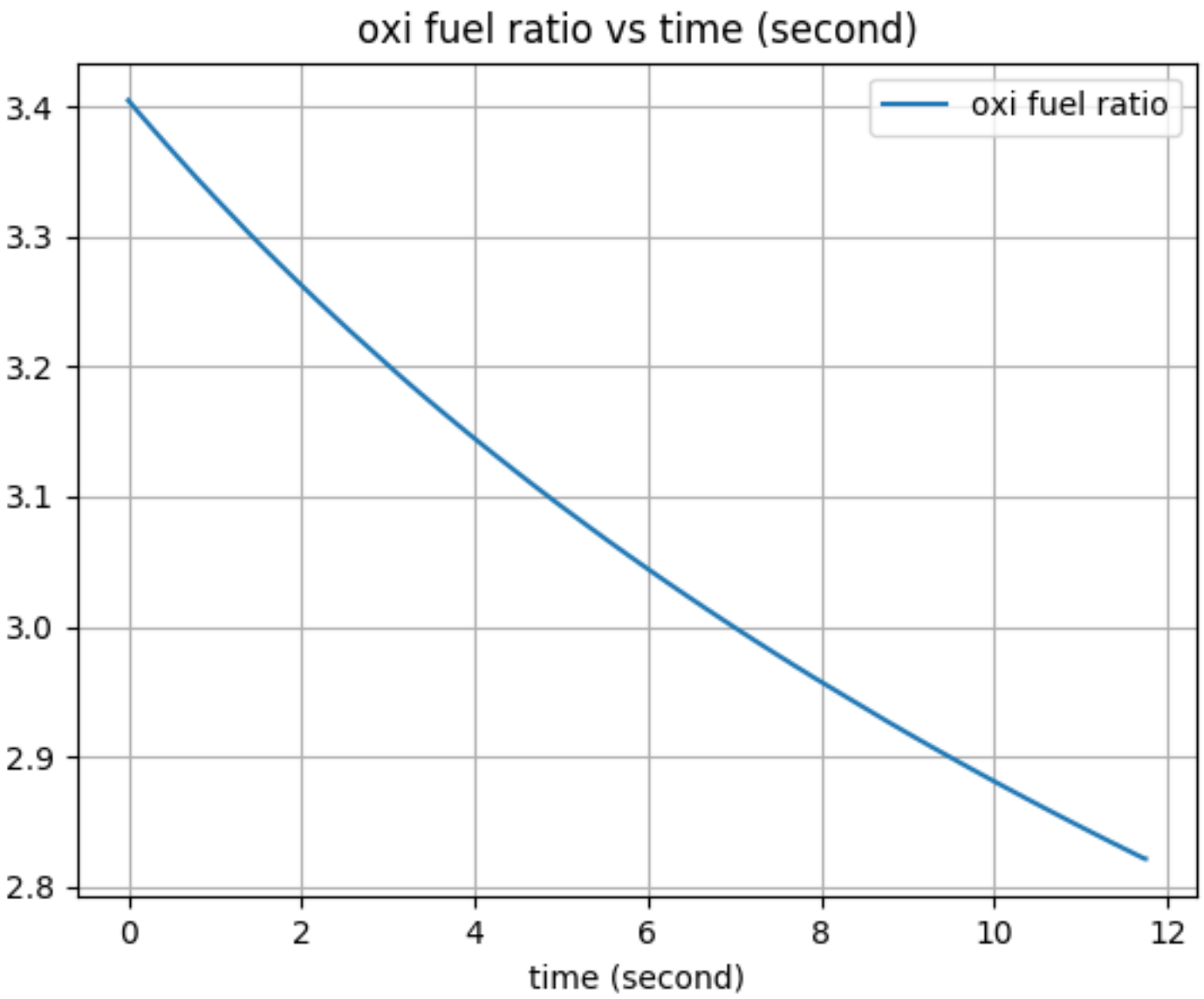

nozzle star temp (degF) vs time (second)
+4.40305e3
nozzle star temp (degF)
0.0080
0.0075
0.0070
0.0065
0.0060
0
2
4
6
8
10
12
time (second)

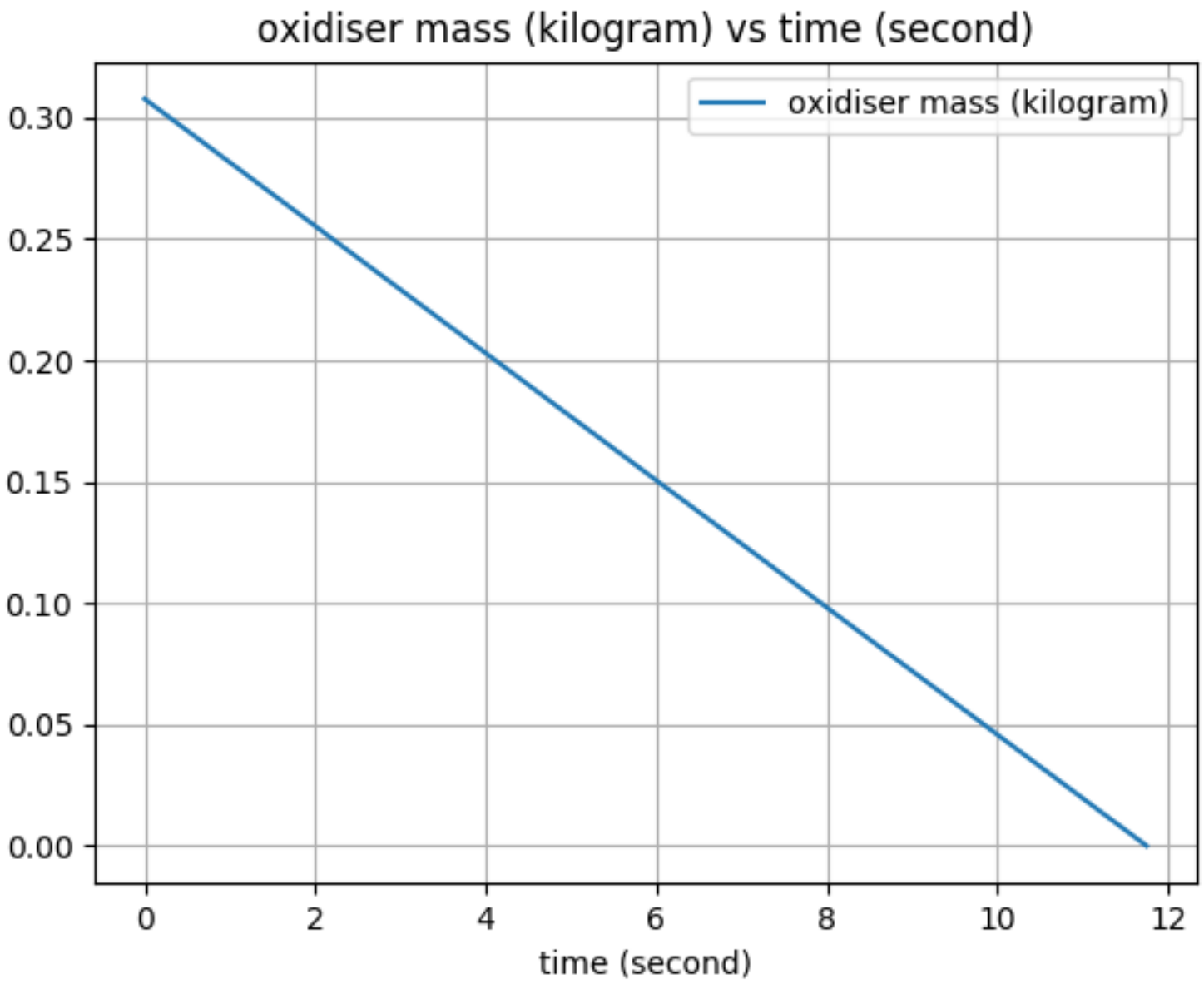

nozzle star velocity (mph) vs time (second)
+2.192267e3
0.0006
0.0005
0.0004
0.0003
0.0002
0.0001
nozzle star velocity (mph)
0
2
4
6
8
10
12
time (second)

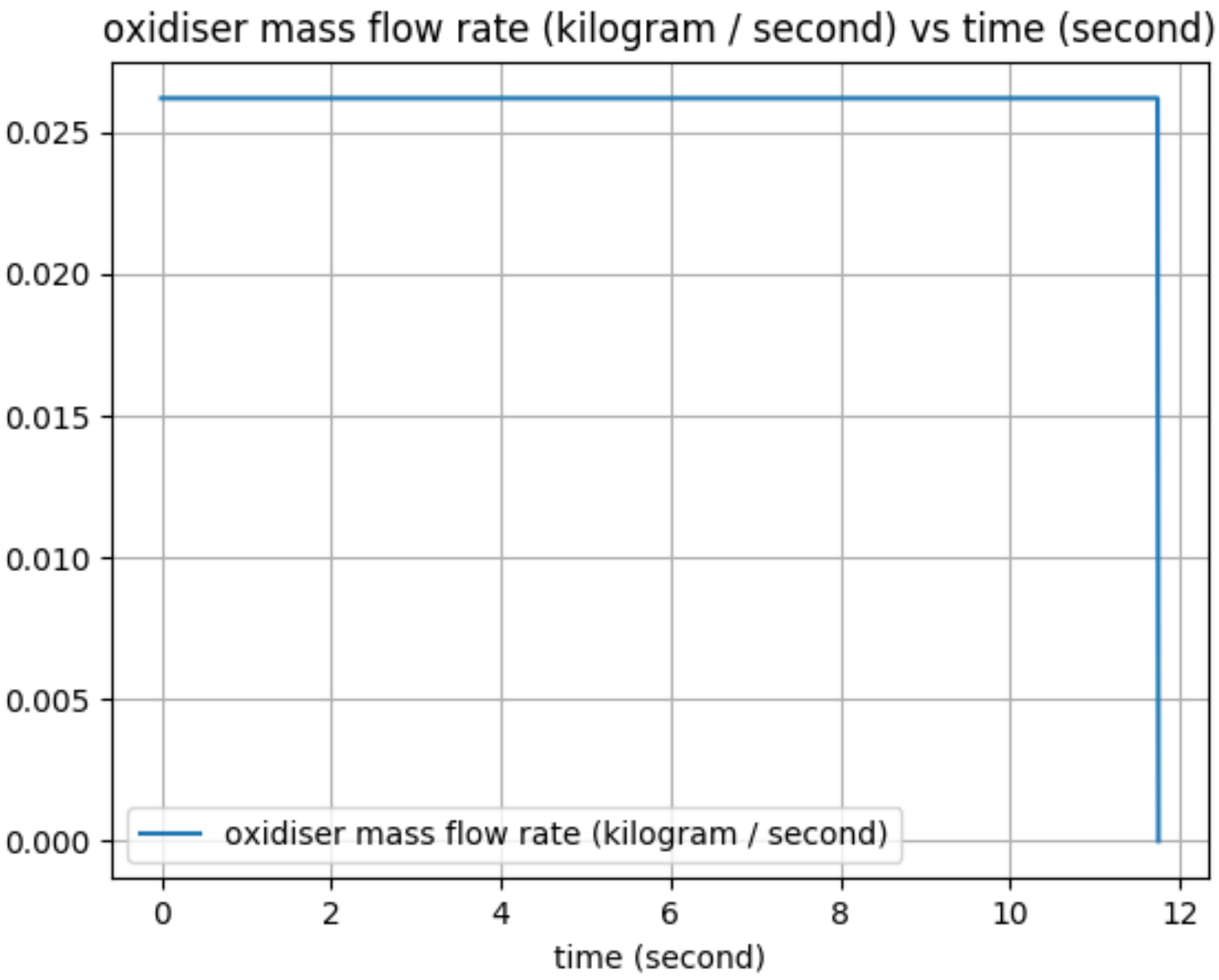

nozzle throat area (inch ** 2) vs time (second)
0.020
0.015
0.010
0.005
0.000
0
2
4
6
8
10
12
time (second)
nozzle throat area (inch ** 2)


nozzle throat diameter (inch) vs time (second)
0.175
0.150
0.125
0.100
0.075
0.050
0.025
0.000
nozzle throat diameter (inch)
0
2
4
6
8
10
12
time (second)


nozzle thrust (newton) vs time (second)
100
80
60
40
20
0
0
2
4
6
8
10
12
time (second)
nozzle thrust (newton)


oxi fuel ratio vs time (second)
oxi fuel ratio
3.4
3.3
3.2
3.1
3.0
2.9
2.8
0
2
4
6
8
10
12
time (second)


oxidiser mass (kilogram) vs time (second)
oxidiser mass (kilogram)
0.30
0.25
0.20
0.15
0.10
0.05
0.00
0
2
4
6
8
10
12
time (second)


oxidiser mass flow rate (kilogram / second) vs time (second)
0.025
0.020
0.015
0.010
0.005
0.000
oxidiser mass flow rate (kilogram / second)
0
2
4
6
8
10
12
time (second)