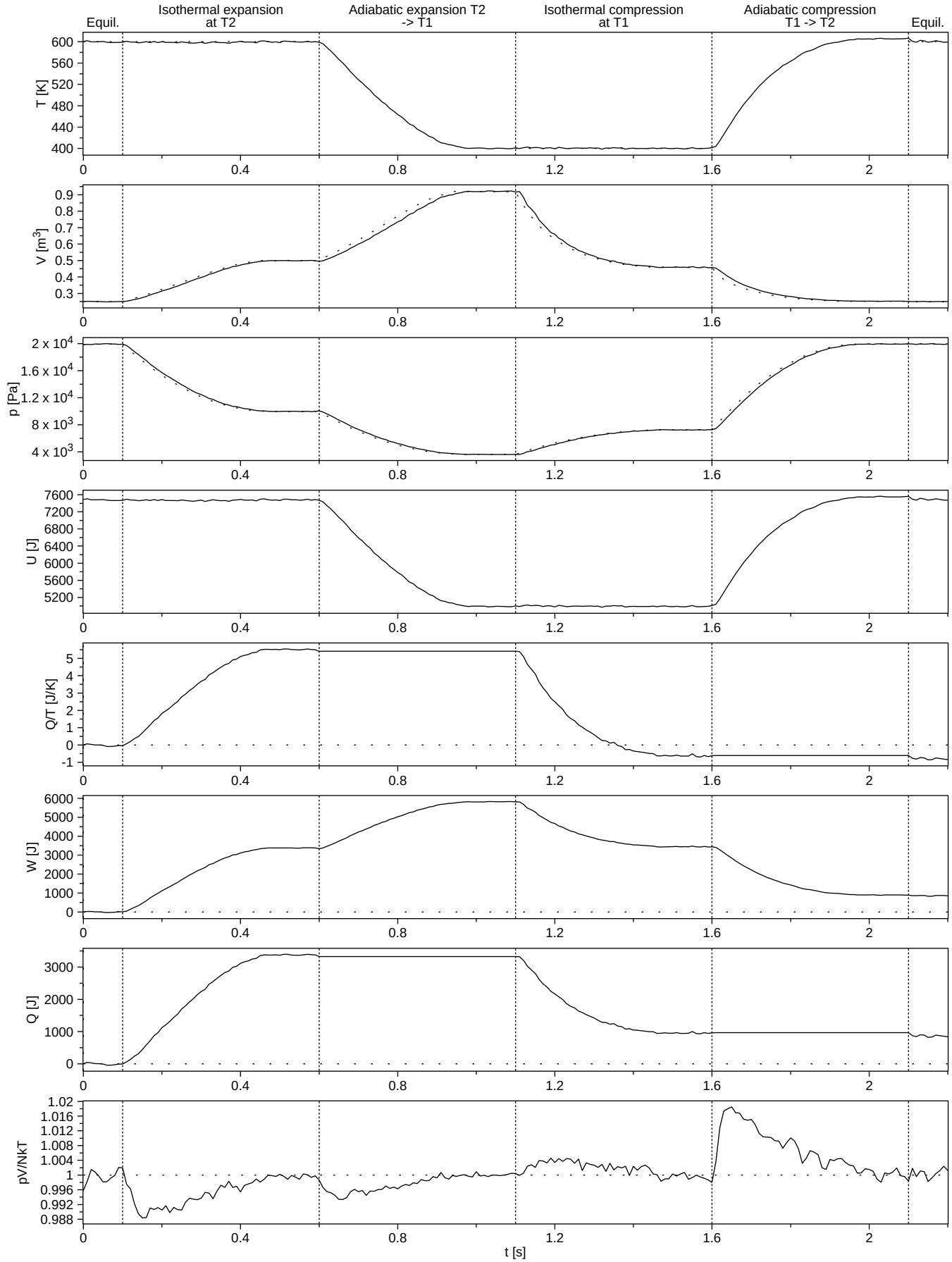
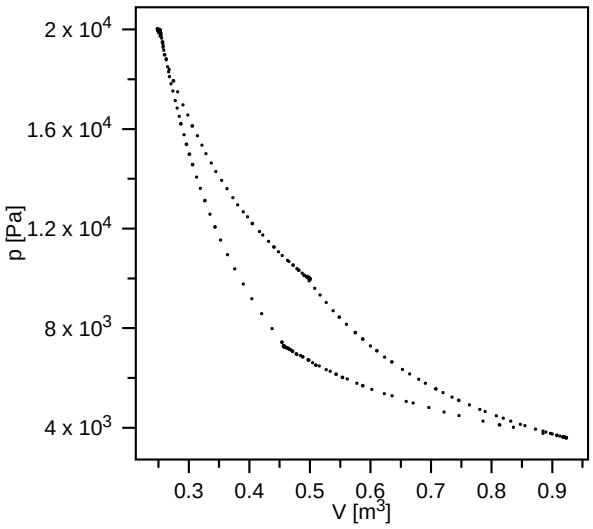
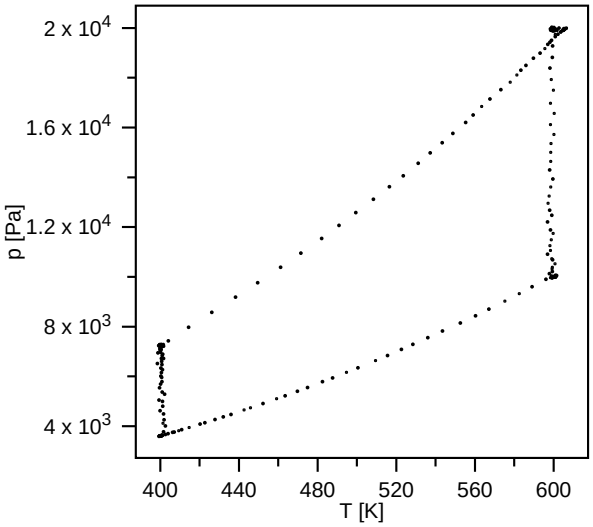
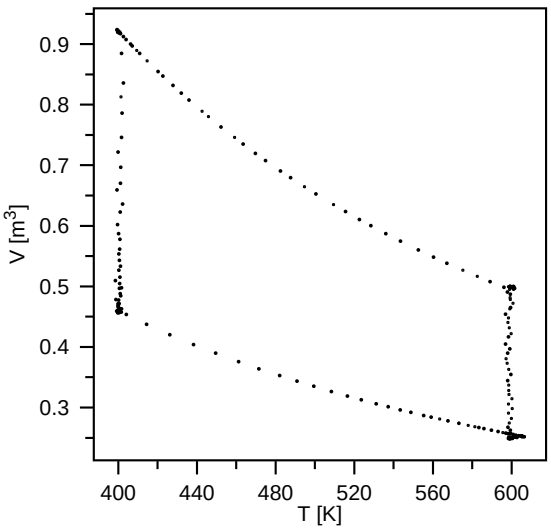
Carnot cycle



Carnot cycle





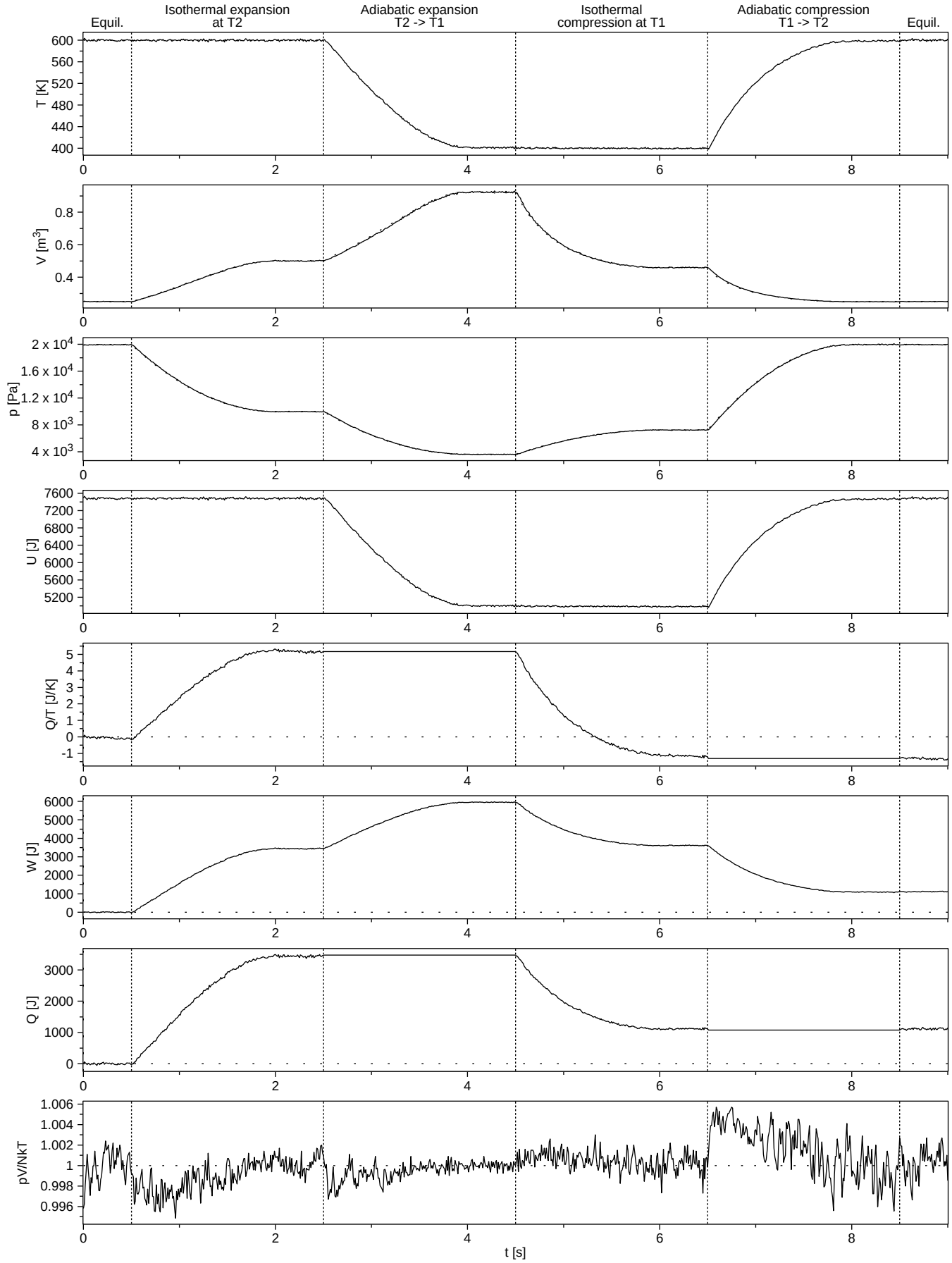



```
Energy-Energy0-Heat+Work     : -8.1945E-10 J
Total work done by system    :      829.62 J
Total heat brought to system :      825.91 J
Total entropy change         :    -0.86565 J/K
Efficiency = Work/Heat(Thigh):      25.948 %
```

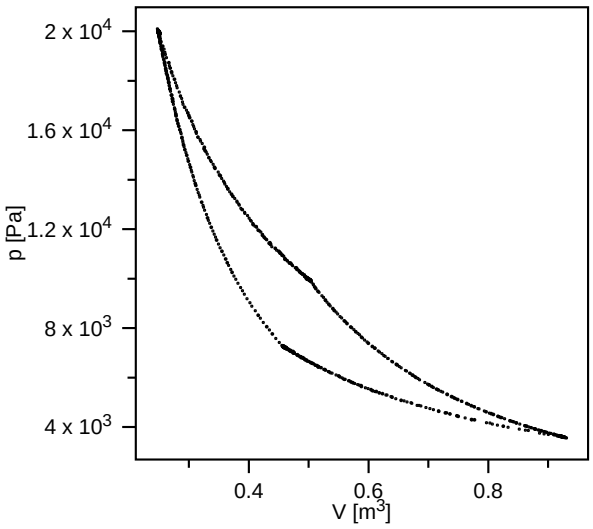
Input file cycleshort.txt:

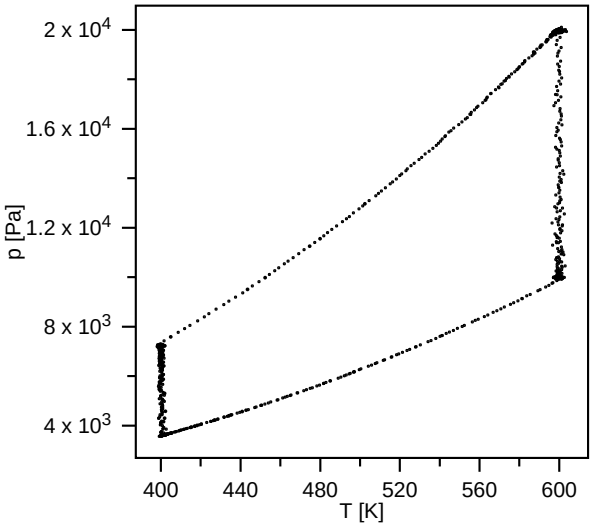
```
title='Carnot cycle'

# ------ initial parameter values ------

ntotal=6.02214E23         # total number of particles (1 mol)
n=50000                   # number of simulated particles
mass=4.64951E-26          # mass of particles [kg] (N2 molecule)
box=1.0,1.0,0.25          # initial box size [m]
tempinit=600.0            # initial temperature [K]
seed=3772                 # random number generator seed
dt=2.0E-5                 # time step [s]
wallmass=0                # boxer: mass of movable wall [kg] (0 for rigid wall)
rheat=1000.0              # heater: heating events per particle and unit time [1/s]
rmix=100.0                # mixer: mixing events per particle and unit time [1/s]
dtprint=0.01              # time interval for reporting [s]
dtave=0.01                # time interval for averaging [s]
report='Time,Step,Temperature,Volume,Pressure,ExtPressure,Energy,Entropy,Work,Heat,Ideality'
                          # quantities to report
#plotfile='cycle.grf'     # plot file

# ------ stage-specific parameter values ------

stage='Equil.'
  duration=0.1            # duration [s]
  tempheater=600.0        # heat bath temperature [K] (0 for adiabatic)
  wallmass=0.2            # mass of movable wall [kg] (0 for rigid wall)
  pressext=19954.7        # external pressure at end of stage

stage='Isothermal expansion at T2'
  duration=0.5
  pressext=9977.35
  storeheat=1             # store heat values for efficiency calculation
  storework=1             # store work values for efficiency calculation

stage='Adiabatic expansion T2 -> T1'
  tempheater=0
  pressext=3620.65
  storeheat=0             # stop storing heat for efficiency calculation

stage='Isothermal compression at T1'
  tempheater=400.0
  pressext=7241.31

stage='Adiabatic compression T1 -> T2'
  tempheater=0
  pressext=19954.7

stage='Equil.'
  duration=0.1
  tempheater=600.0
  wallmass=0.2
  pressext=19954.7
  storeheat=1             # store heat values for efficiency calculation

end
```

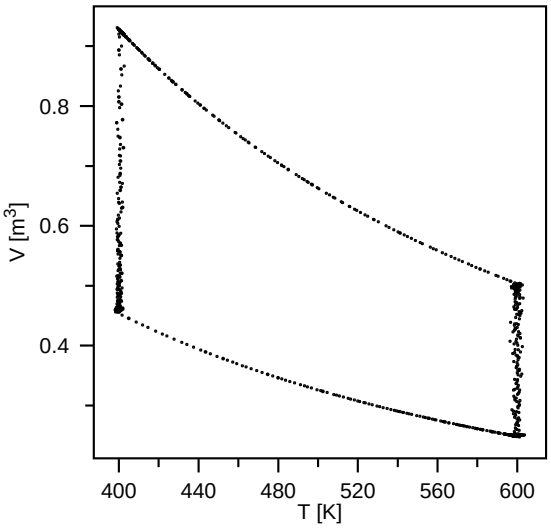
Carnot cycle



Carnot cycle





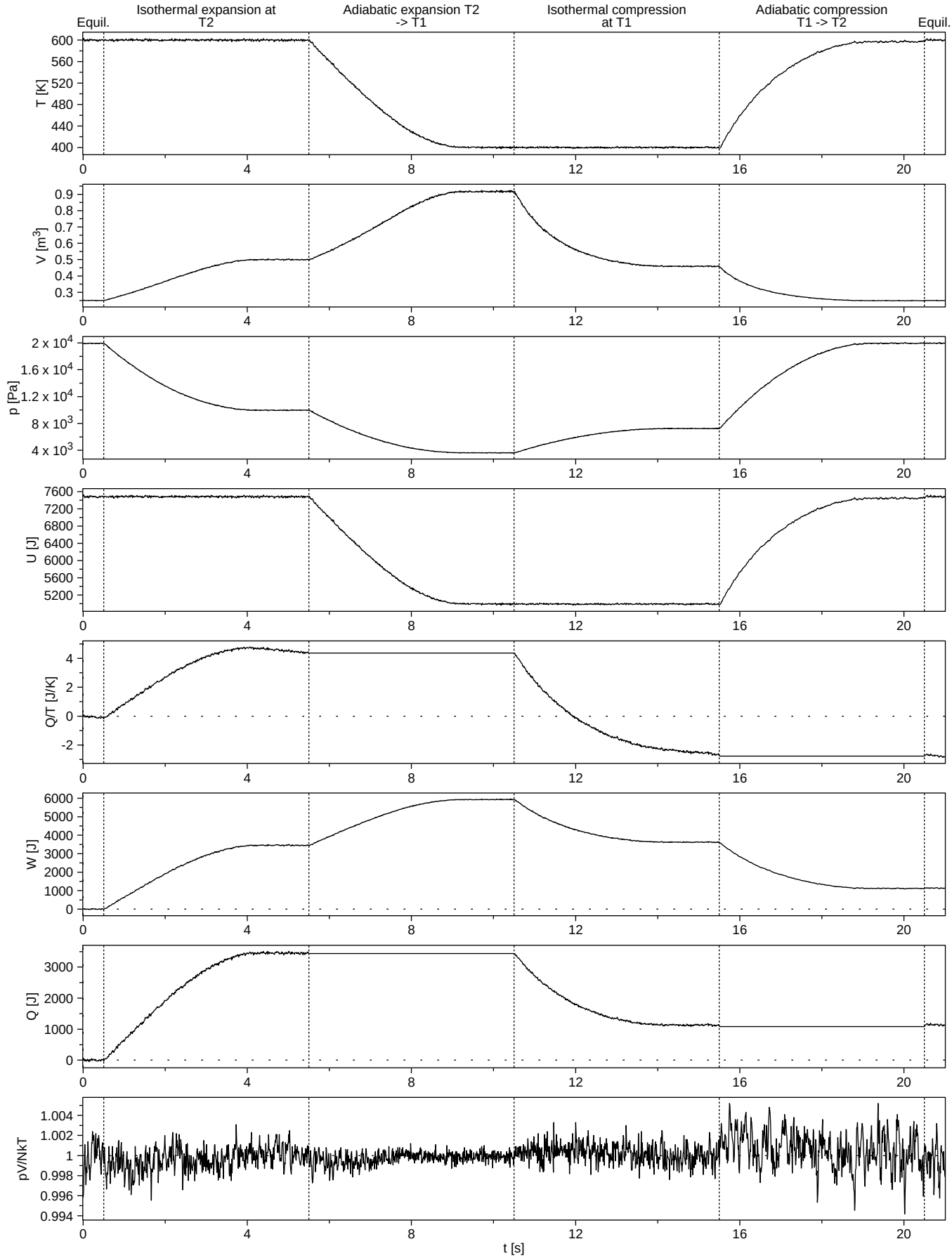



```
Energy-Energy0-Heat+Work     :  -2.663E-09 J
Total work done by system    :      1155.7 J
Total heat brought to system :      1193.7 J
Total entropy change         :     -1.2459 J/K
Efficiency = Work/Heat(Thigh):      31.701 %
```

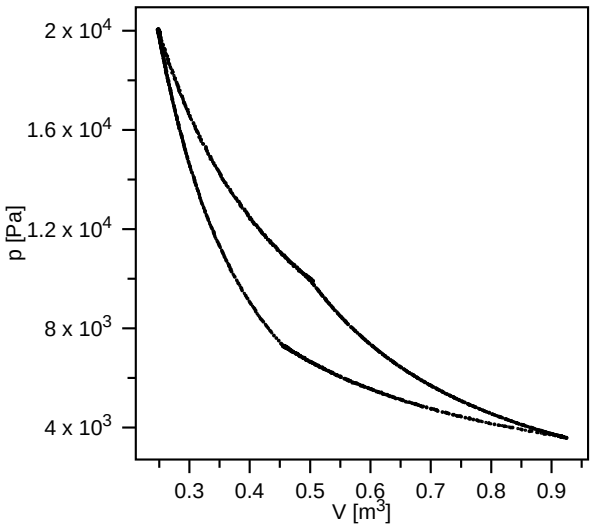
Input file cyclelong.txt:

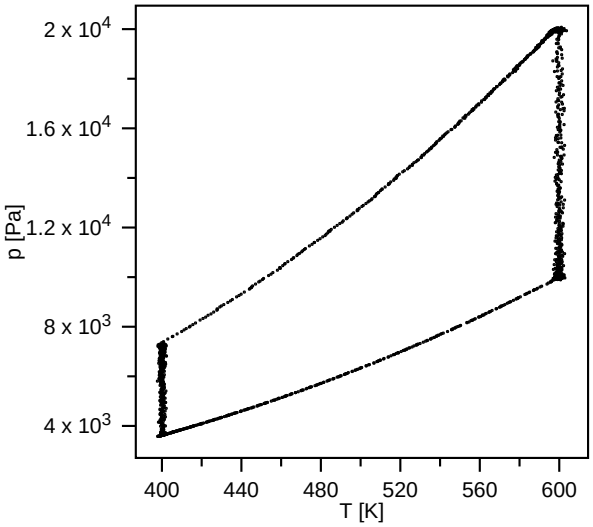
```
title='Carnot cycle'

# ------ initial parameter values ------

ntotal=6.02214E23         # total number of particles (1 mol)
n=50000                   # number of simulated particles
mass=4.64951E-26          # mass of particles [kg] (N2 molecule)
box=1.0,1.0,0.25          # initial box size [m]
tempinit=600.0            # initial temperature [K]
seed=3772                 # random number generator seed
dt=2.0E-5                 # time step [s]
wallmass=0                # boxer: mass of movable wall [kg] (0 for rigid wall)
rheat=1000.0              # heater: heating events per particle and unit time [1/s]
rmix=100.0                # mixer: mixing events per particle and unit time [1/s]
dtprint=0.01              # time interval for reporting [s]
dtave=0.01                # time interval for averaging [s]
report='Time,Step,Temperature,Volume,Pressure,ExtPressure,Energy,Entropy,Work,Heat,Ideality'
                          # quantities to report
#plotfile='cycle.grf'     # plot file

# ------ stage-specific parameter values ------

stage='Equil.'
  duration=0.5            # duration [s]
  tempheater=600.0        # heat bath temperature [K] (0 for adiabatic)
  wallmass=0.2            # mass of movable wall [kg] (0 for rigid wall)
  pressext=19954.7        # external pressure at end of stage

stage='Isothermal expansion at T2'
  duration=2.0
  pressext=9977.35
  storeheat=1             # store heat values for efficiency calculation
  storework=1             # store work values for efficiency calculation

stage='Adiabatic expansion T2 -> T1'
  tempheater=0
  pressext=3620.65
  storeheat=0             # stop storing heat for efficiency calculation

stage='Isothermal compression at T1'
  tempheater=400.0
  pressext=7241.31

stage='Adiabatic compression T1 -> T2'
  tempheater=0
  pressext=19954.7

stage='Equil.'
  duration=0.5
  tempheater=600.0
  wallmass=0.2
  pressext=19954.7
  storeheat=1             # store heat values for efficiency calculation

end
```

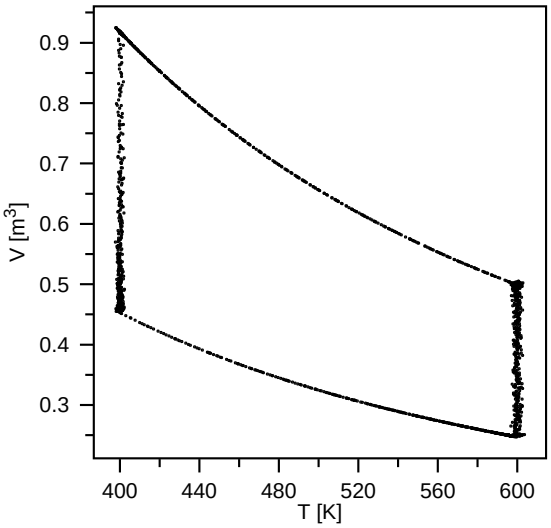
Carnot cycle



Carnot cycle








```
Energy-Energy0-Heat+Work     : -5.4661E-09 J
Total work done by system    :      1102.4 J
Total heat brought to system :      1142.5 J
Total entropy change         :     -2.7936 J/K
Efficiency = Work/Heat(Thigh):       31.03 %
```

Input file cycleverylong.txt:

```
title='Carnot cycle'

# ------ initial parameter values ------

ntotal=6.02214E23         # total number of particles (1 mol)
n=50000                   # number of simulated particles
mass=4.64951E-26          # mass of particles [kg] (N2 molecule)
box=1.0,1.0,0.25          # initial box size [m]
tempinit=600.0            # initial temperature [K]
seed=3772                 # random number generator seed
dt=2.0E-5                 # time step [s]
wallmass=0                # boxer: mass of movable wall [kg] (0 for rigid wall)
rheat=1000.0              # heater: heating events per particle and unit time [1/s]
rmix=100.0                # mixer: mixing events per particle and unit time [1/s]
dtprint=0.01              # time interval for reporting [s]
dtave=0.01                # time interval for averaging [s]
report='Time,Step,Temperature,Volume,Pressure,ExtPressure,Energy,Entropy,Work,Heat,Ideality'
                          # quantities to report
#plotfile='cycle.grf'     # plot file

# ------ stage-specific parameter values ------

stage='Equil.'
  duration=0.5            # duration [s]
  tempheater=600.0        # heat bath temperature [K] (0 for adiabatic)
  wallmass=0.2            # mass of movable wall [kg] (0 for rigid wall)
  pressext=19954.7        # external pressure at end of stage

stage='Isothermal expansion at T2'
  duration=5.0
  pressext=9977.35
  storeheat=1             # store heat values for efficiency calculation
  storework=1             # store work values for efficiency calculation

stage='Adiabatic expansion T2 -> T1'
  tempheater=0
  pressext=3620.65
  storeheat=0             # stop storing heat for efficiency calculation

stage='Isothermal compression at T1'
  tempheater=400.0
  pressext=7241.31

stage='Adiabatic compression T1 -> T2'
  tempheater=0
  pressext=19954.7

stage='Equil.'
  duration=0.5
  tempheater=600.0
  wallmass=0.2
  pressext=19954.7
  storeheat=1             # store heat values for efficiency calculation

end
```