Around permanent regime

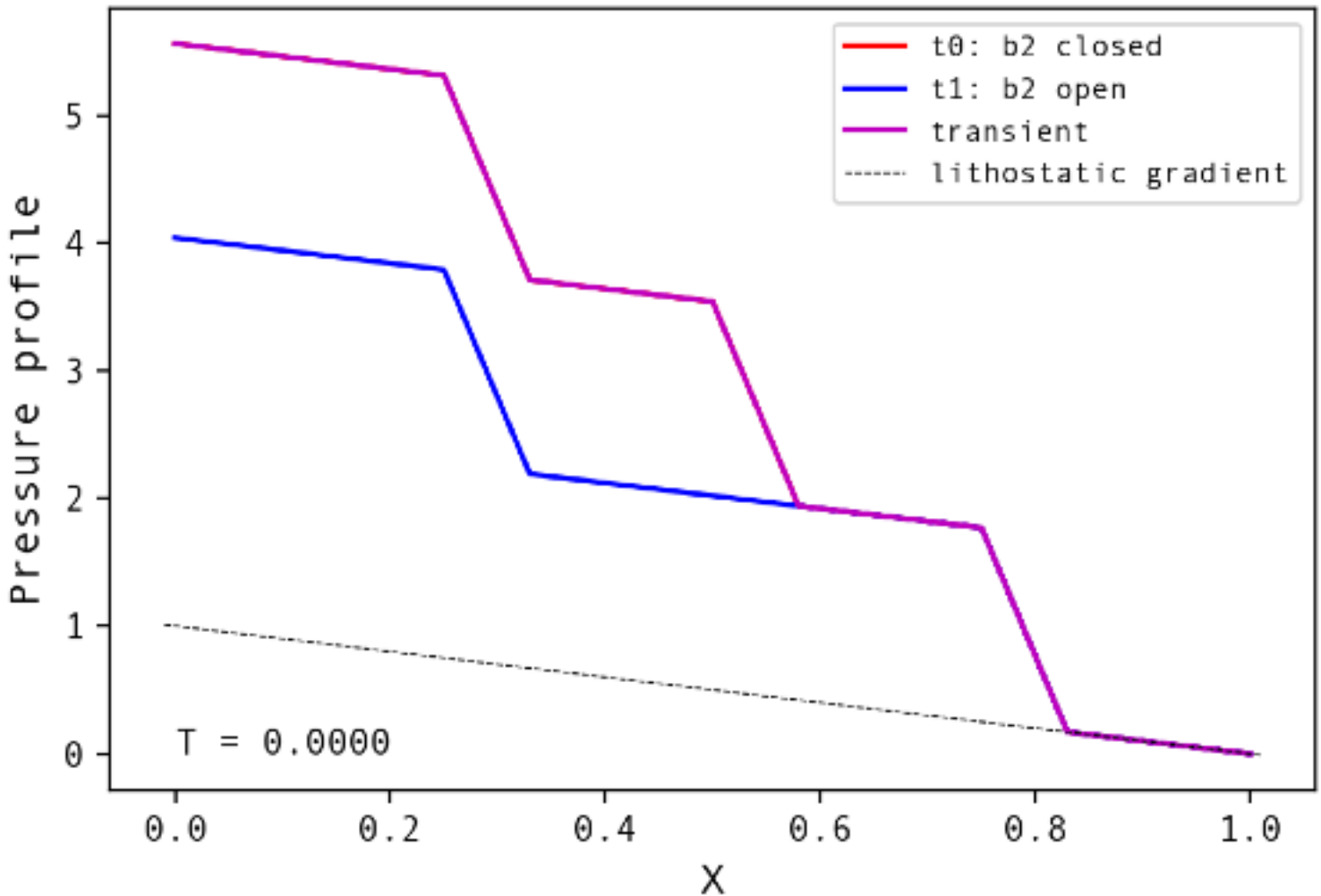
(b) QP boundaries: transient from valve breaking

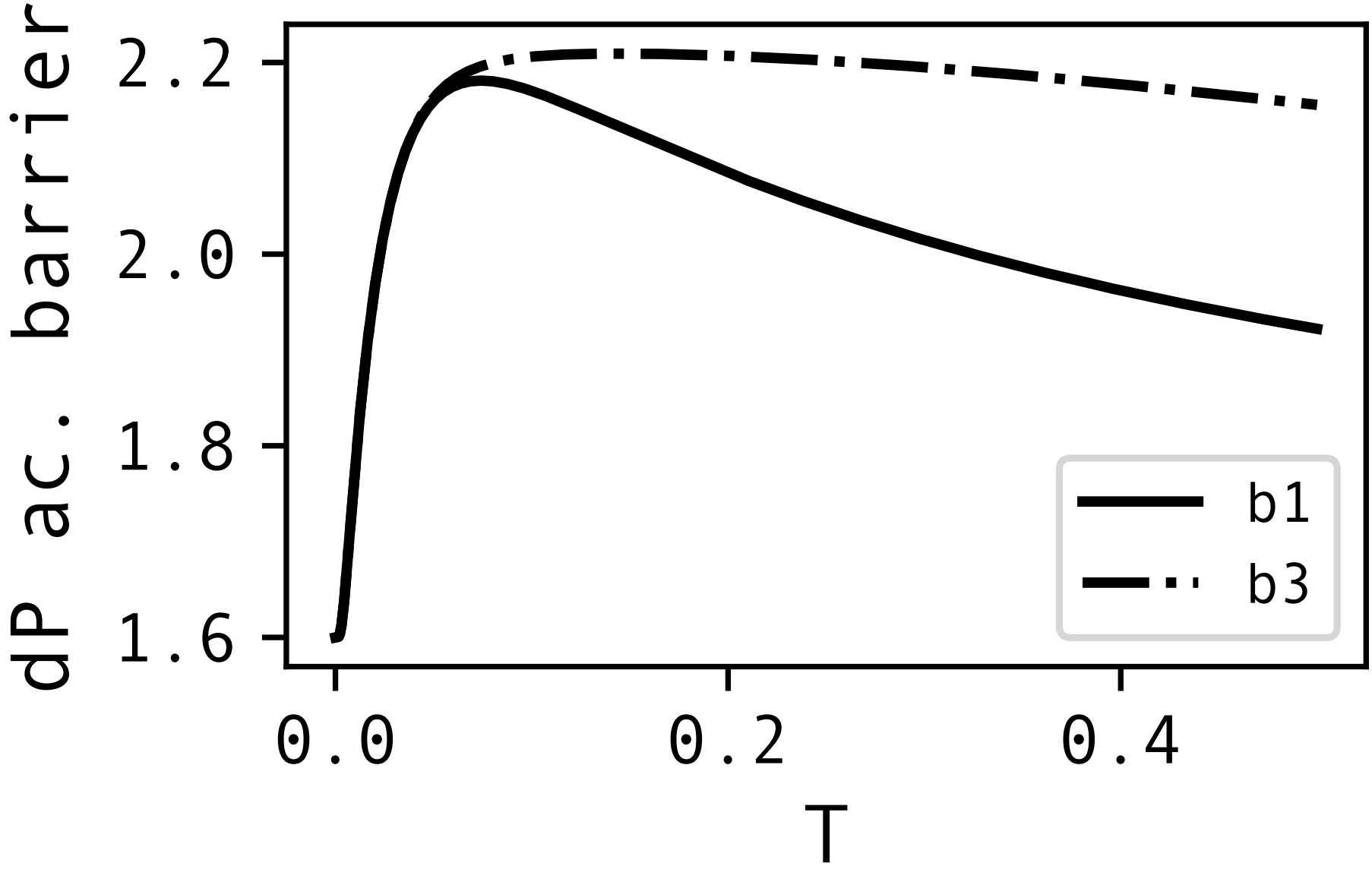
Experiment:

- Init. equilibrium pore-pressure profile when 3 valves are closed, but valve nb2 is open ($k_b = k_{bg}$).
- Observe the propagating transient

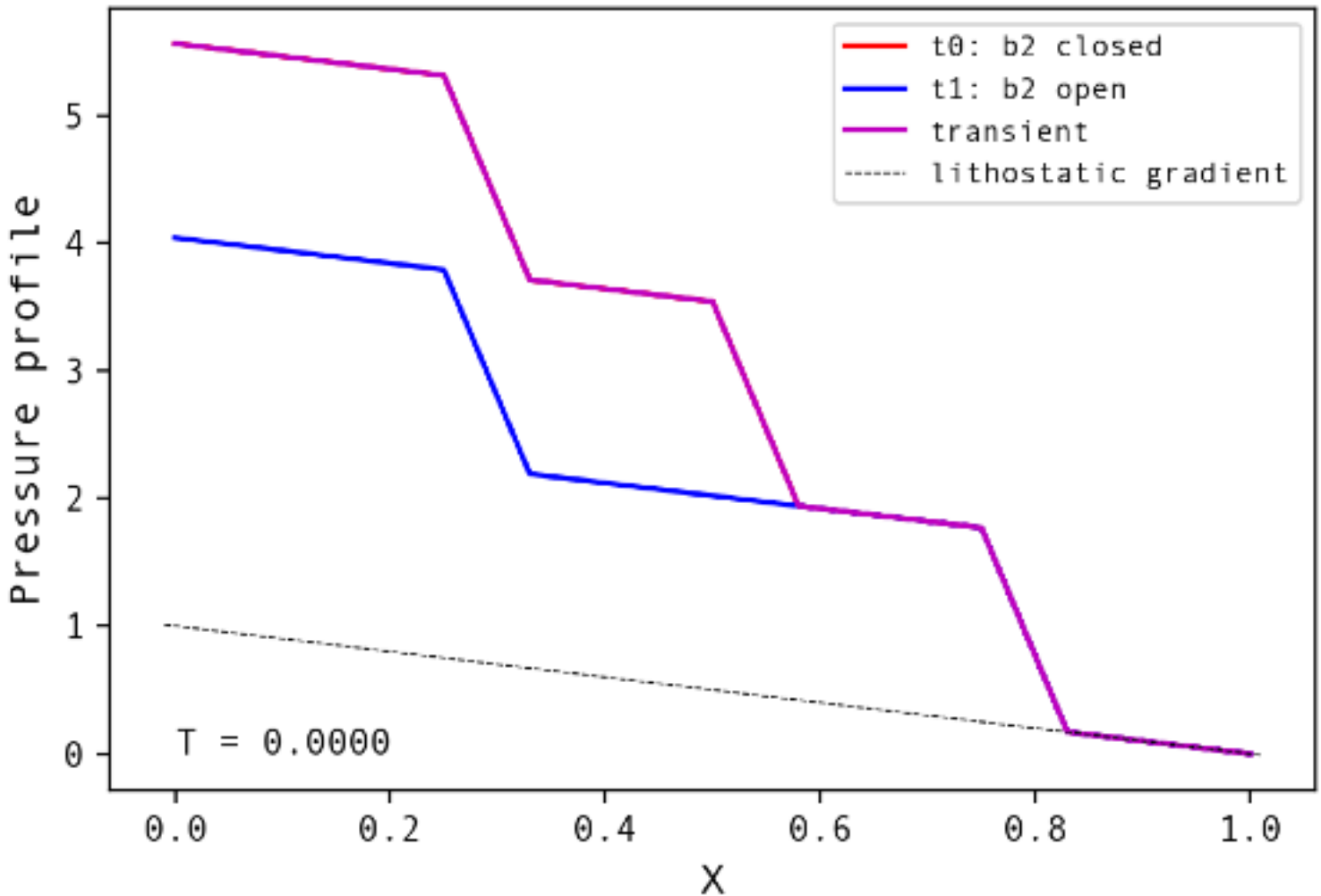
Observation:

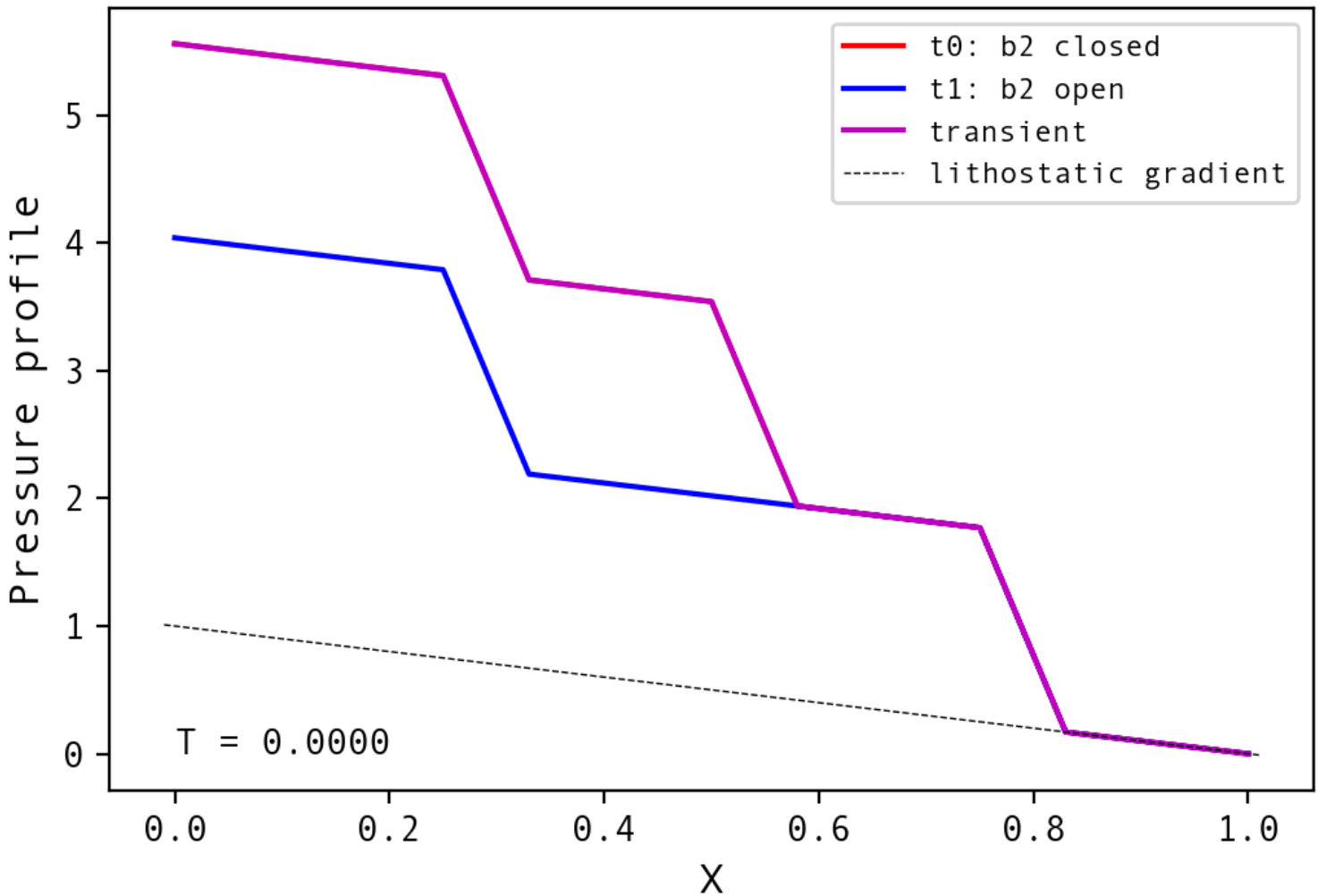
- transient progresses from one valve to the other, to redistribute total dP on background segments and barriers.
- dP across remaining valve and overpressure are increased (closer to failure?)
- The increase is transient, overpressure will progressively dissipate when fluid has crossed the low permeability barriers


t0: b2 closed
t1: b2 open
transient
lithostatic gradient
Pressure profile
X
T = 0.0000
0
1
2
3
4
5
0.0
0.2
0.4
0.6
0.8
1.0


dP ac. barrier
2.2
2.0
1.8
1.6
0.0
0.2
0.4
T
b1
b3

↓ this is a gif, click on it to play


t0: b2 closed
t1: b2 open
transient
lithostatic gradient
Pressure profile
X
T = 0.0000
0
1
2
3
4
5
0.0
0.2
0.4
0.6
0.8
1.0


t0: b2 closed
t1: b2 open
transient
lithostatic gradient
Pressure profile
X
T = 0.0000
0
1
2
3
4
5
0.0
0.2
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1.0

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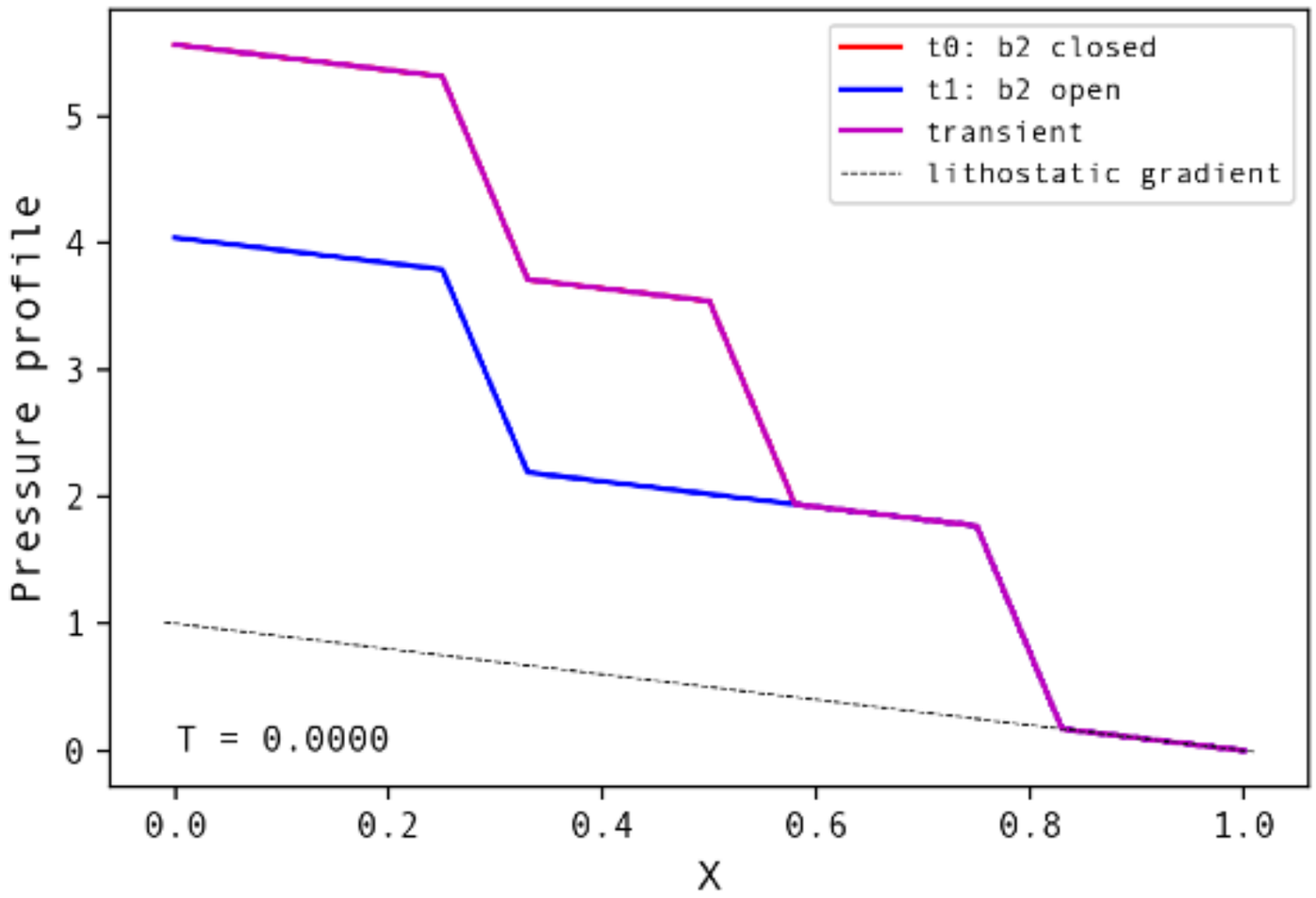

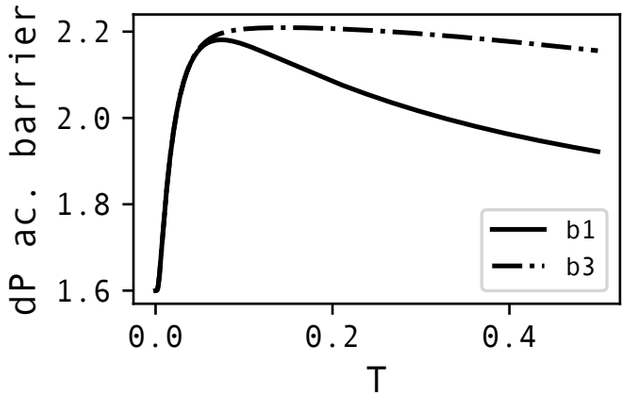

Dynamics of an isolated valve

(a) Experimental setup

In our model, a valve is described by its width *w_b*, its permeability *k_b*, and finally by its opening and closing conditions, which depend on the pressure differential *dP* across the valve:

*dP_open = dpdx_opening * w_b*
*dP_close = dpdx_closing * w_b*

In this experimental set up, *dpdx_open* (*dpdx_hi*), *dpdx_close* (*dpdx_lo*) and *w_b* vary, and *k_b* is fixed at *1e-3 * k_bg*.

The runs are conducted in both fixed pressure and fixed flux boundary conditions.