

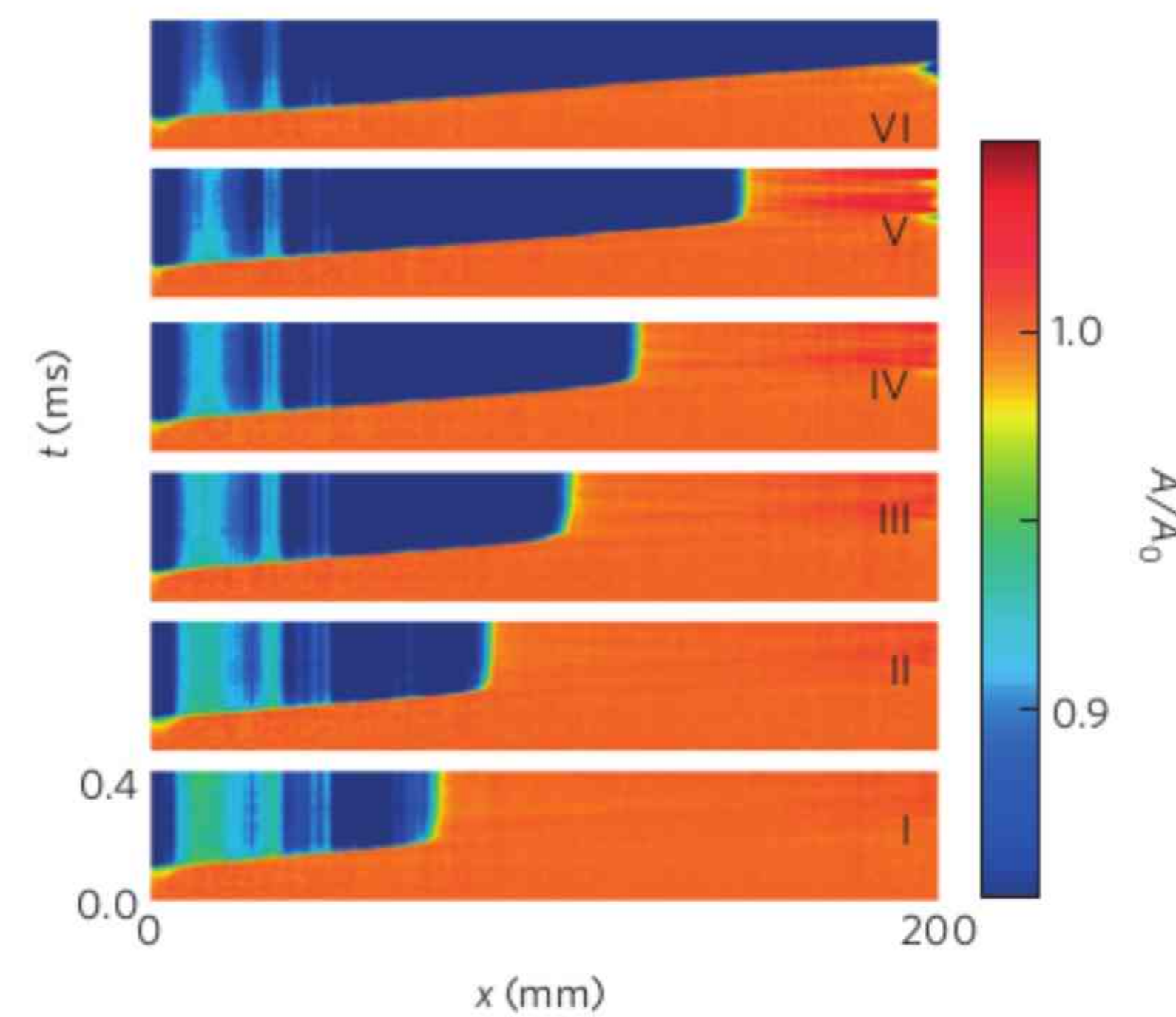
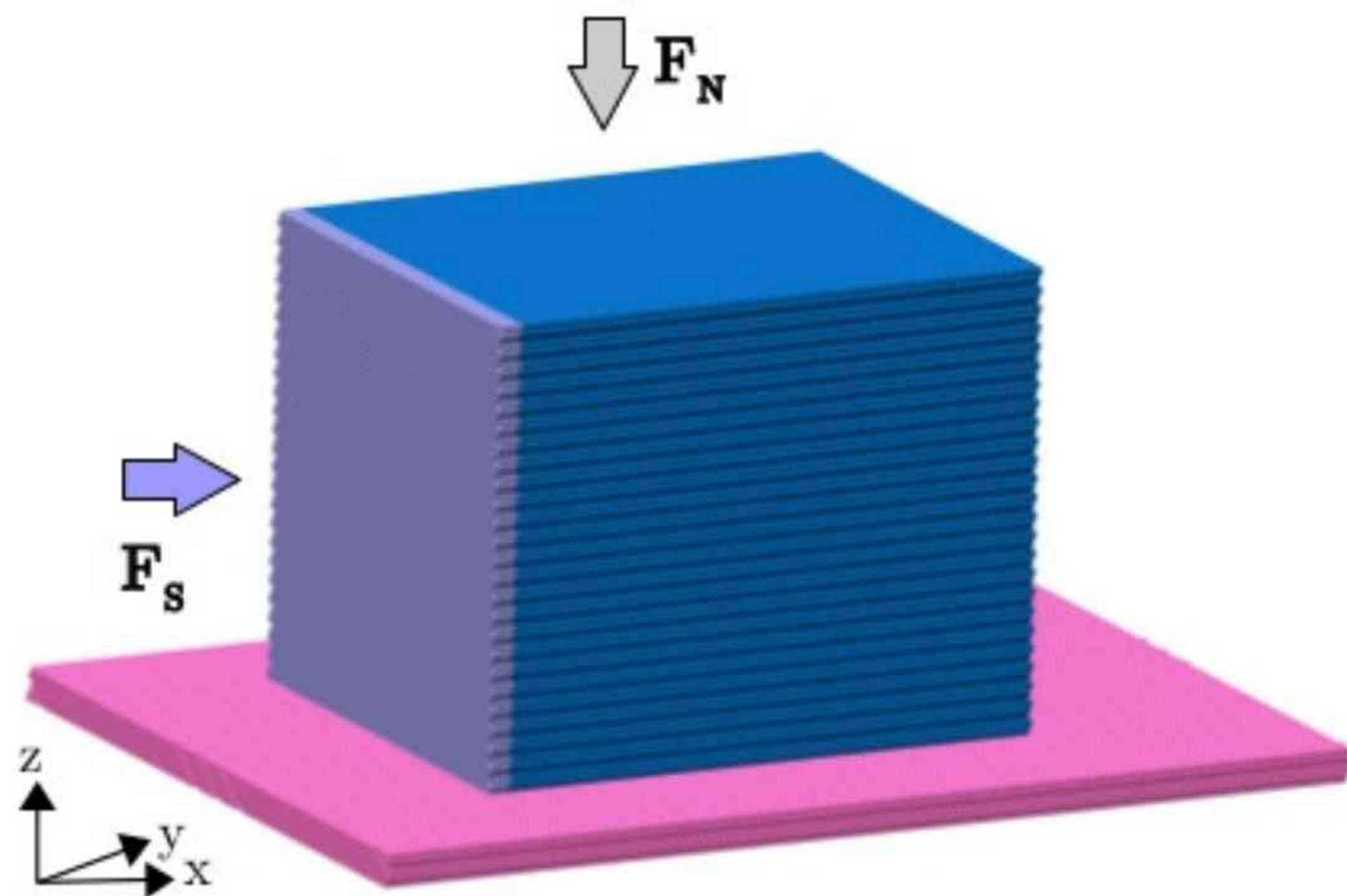
# Atomic scale front propagation at the onset of frictional sliding

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**Friction @ mesoscale** → EXPERIMENTS show slip precursors, detachment fronts at the contact interface occurring before the global sliding [Bayart, Svetlizky, Fineberg, Nat. Phys 2016]

**OUR MOTIVATION: Understanding Friction @ NANOScale**  
Implementation of a simple setting for molecular dynamics study



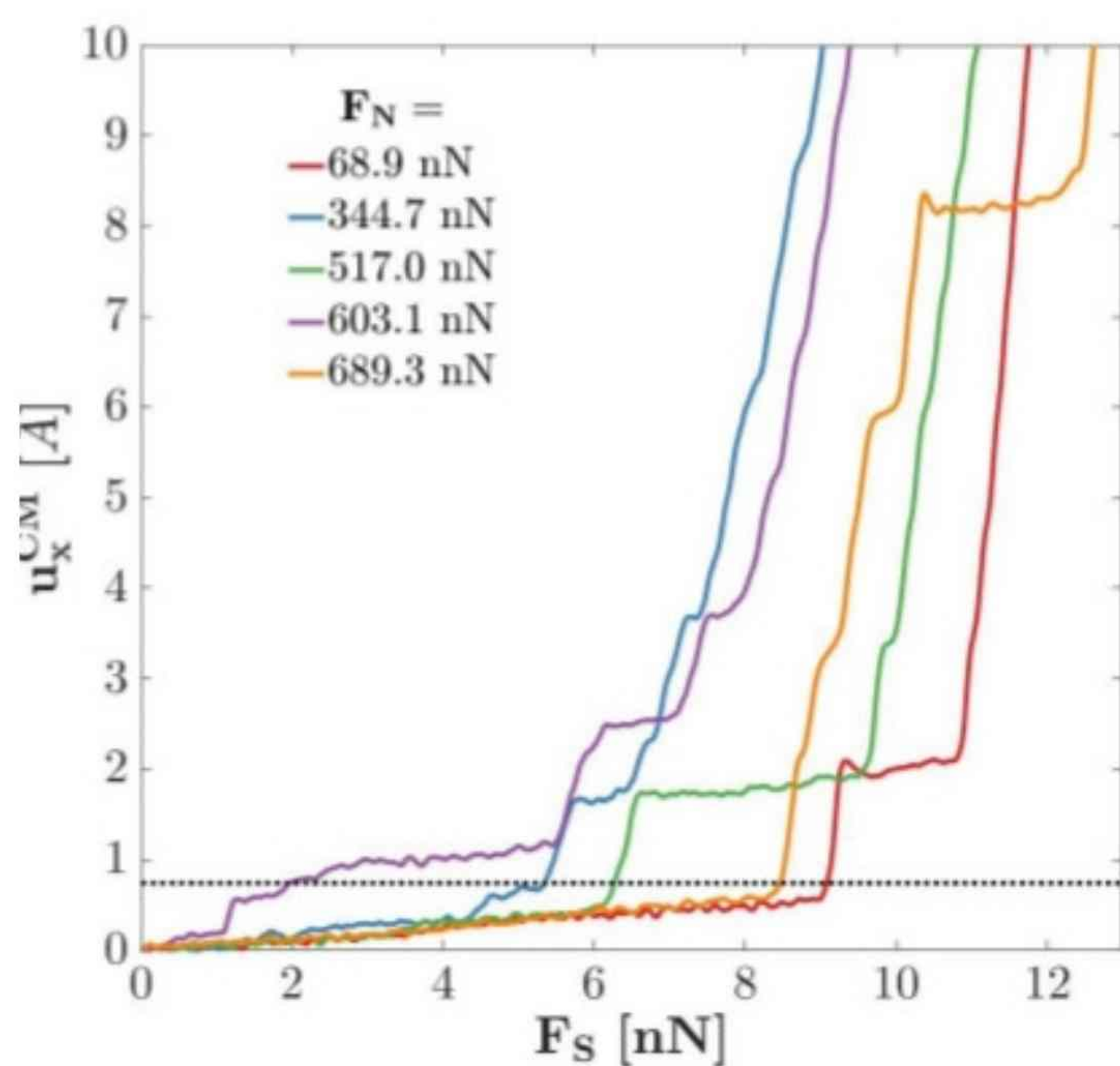
**Target system and method:**

- **Al block:** 23x18x17 nm & **Cu substrate:** 40x33x1 nm
- **Material specific potential:** Embedded Atom Potential
- **DYNAMICS:** Application of a loading force  $F_N$  along  $z$ . Addition of a shear force  $F_S$  only to the few lateral layer of atoms along  $x$  ( $F_N/F_S=0.1$ ). Langevin thermostat.
- **POTENTIAL ENERGY LANDSCAPE:** athermal quasi static simulations (no thermal fluctuations)

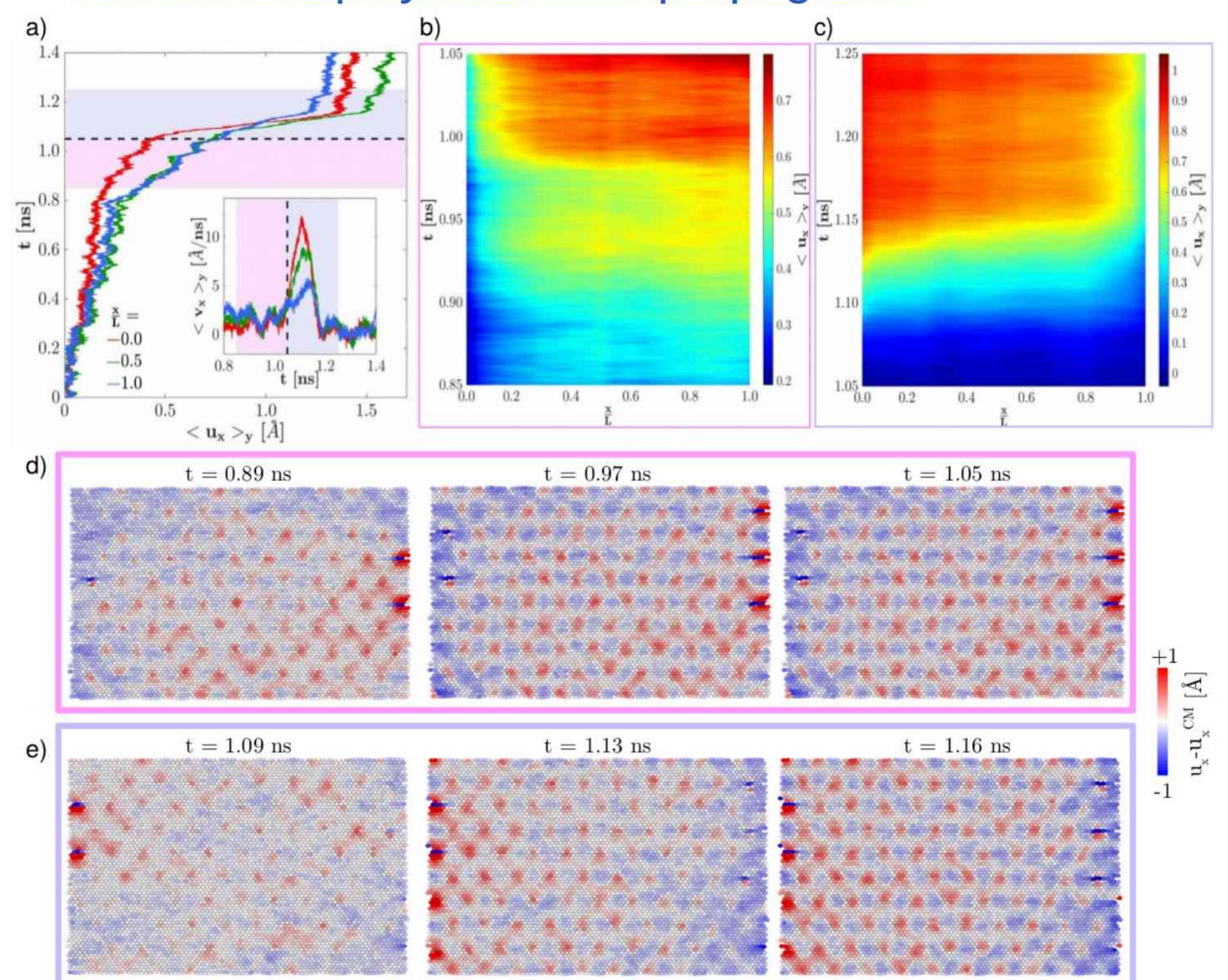
**DYNAMICS (T=50K):**

step-like motion: precursor to the global sliding

$u_x^{CM}$ : displacement of CM of the block

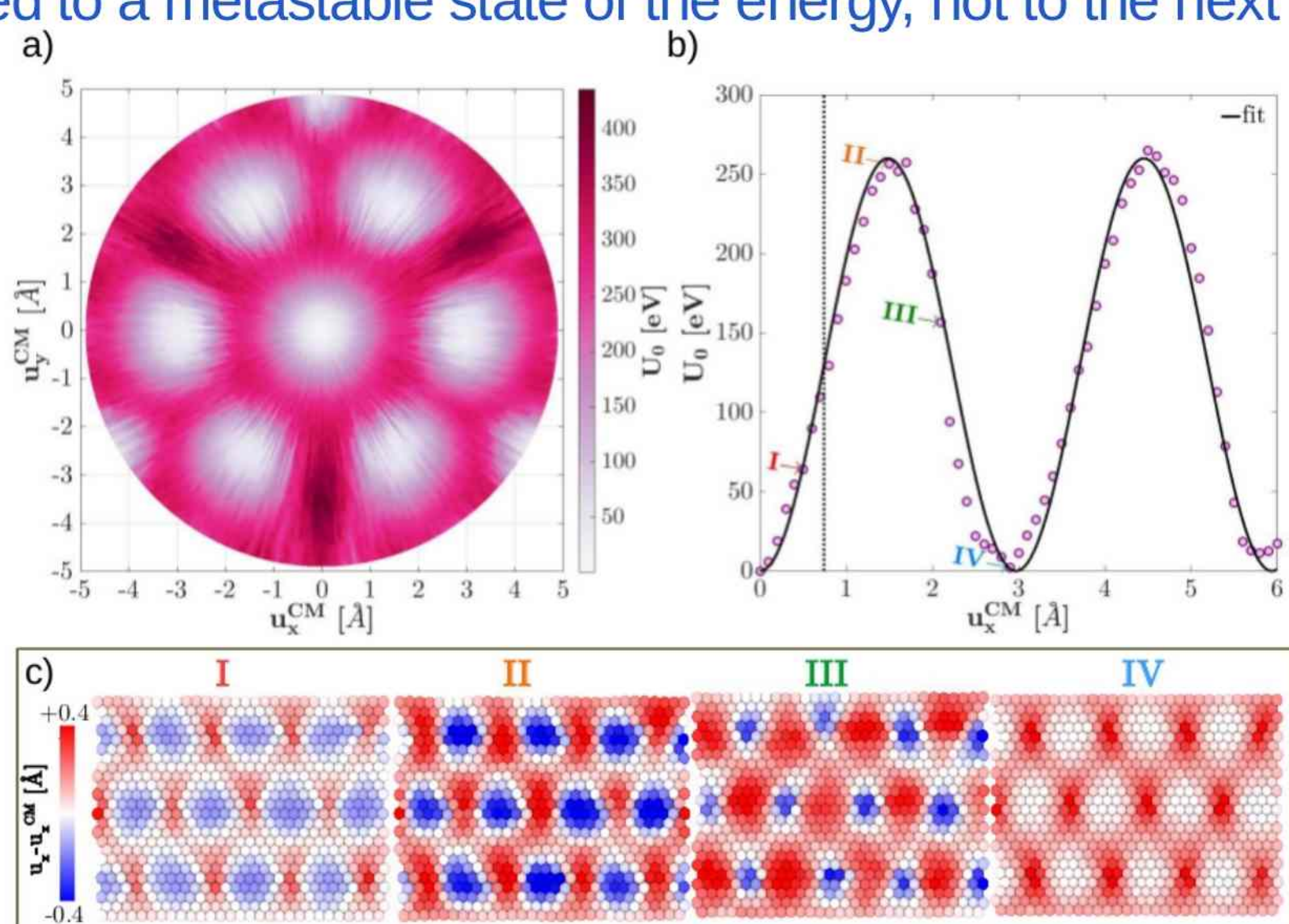


**Atomic-scale slip precursors at the contact interface display crack-like propagation**



**ENERGY LANDSCAPE MAP: quasi equilibrium**

displacement does not reveal slip fronts. The dynamic fronts are related to a metastable state of the energy, not to the next minimum



**DYNAMICS (T=10<sup>-3</sup>K): atomistic effects rule stress profile**

The precursor activity is associated to the displacement of shear fronts

