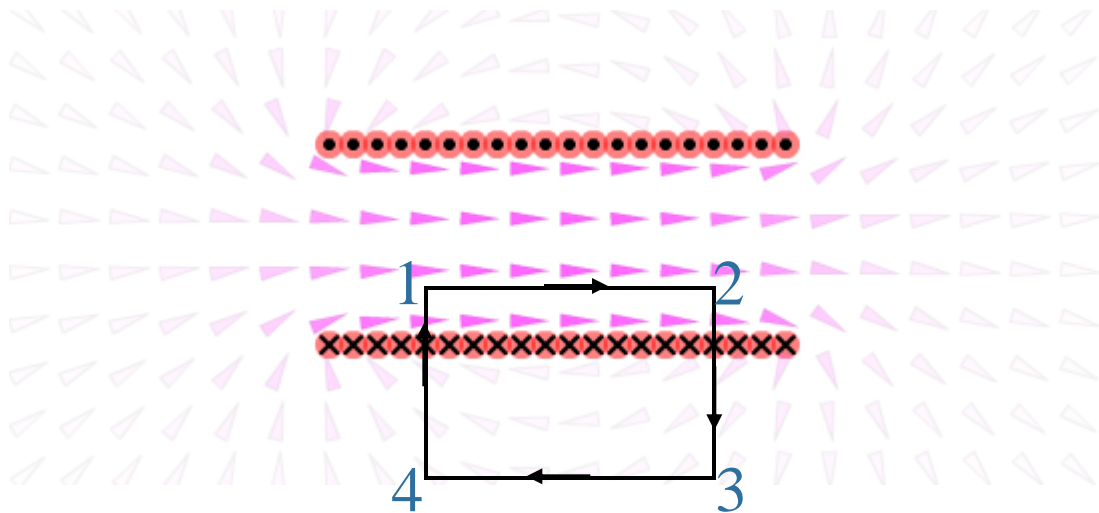


# Solenoid

Several loops packed tightly together form a uniform magnetic field inside, and nearly zero magnetic field outside.



From this simulation, we can assume a constant field inside the solenoid and zero field outside the solenoid, and apply Ampere's law to find the magnitude of the constant field inside the solenoid!

$$\oint \vec{B} \cdot d\vec{\ell} = \mu_o I_{enc} \quad \longrightarrow \quad \int_1^2 \vec{B} \cdot d\vec{\ell} + \int_2^3 \vec{B} \cdot d\vec{\ell} + \int_3^4 \vec{B} \cdot d\vec{\ell} + \int_4^1 \vec{B} \cdot d\vec{\ell} = \mu_o I_{enc}$$

$$BL + 0 + 0 + 0 = \mu_o I_{enc} \quad \longrightarrow \quad BL = \mu_o nLI \quad \longrightarrow \quad B = \mu_o nI$$

$n = \# \text{ turns/length}$