

# Engineering coils to create designed magnetic fields

To study how charged particles behave inside magnetic fields, it is useful to generate spatial regions with uniform magnetic field strength and uniform magnetic field direction. How can we use a current loop to generate a spatial volume with these properties?

OK	Better
Single loop	Solenoid
<p>Vaguely uniform  <math>\vec{B}</math>-field strength and direction in                      small volume                      (near center of loop)</p>	<p>Highly uniform  <math>\vec{B}</math>-field strength and direction in                      majority of interior                      of the coil (except near edges); negligible strength outside (except near edges)</p>
$B = \frac{\mu_0 I}{2R}$	$B = \mu_0 \frac{N}{\ell} I$ $n = \frac{N}{\ell}$