Dear Jonathan,

please calculate the field density depending on the distance to the pole by the following formula:

\[ B = \mu_0 \frac{I}{l} \]

with

- \( I \) electrical current
- \( l \) distance to the pole (end of the coil), \( l \) and not \( l^2 \) as I wrote yesterday!

I calculated the field-density in a distance of 1 cm for the dimensions of your coil and got with 450 nT at the pole, 66,6 μ A:

8,36 nT.

If we say, that we want to have 450 nT instead of 8,36 nT in the same distance, we have to calculate for your coil the electrical current to

\[ I = \frac{B \cdot l}{\mu_0} = \frac{450 \text{Vs} \cdot 1 \text{cm}}{10^9 \text{m}^2} \cdot \frac{m}{10^2 \text{cm}} \cdot \frac{10^7 \text{Am}}{4\pi \text{Vs}} = 3,582 \cdot 10^{-3} \text{A} = 3,58 \text{mA} \]

That means, you will have to feed your coil with about 3,6 mA. The flux density at the pole will than be

\[ B = \frac{L \cdot I}{N \cdot A} = \frac{3,13 \text{Vs}}{10^3 \text{Am}} \cdot \frac{1}{2,06 \cdot 10^2 \text{mm}^2} \cdot \frac{10^6 \text{mm}^2}{1 \text{m}^2} \cdot \frac{I}{2,25 \cdot 10^2} = 6,7568 \cdot 10^{-3} \cdot 3,5828 \cdot 10^{-3} = 24,20 \cdot 10^{-6} \left[ \frac{\text{Vs}}{\text{m}^2} \right] \]

\[ B = 24,20 \mu \text{T} \]

Your supply voltage is 9V.
In this case you need a pre-resistor \( R \)

\[ R = \frac{9 \text{V}}{3,58 \text{mA}} \cdot \frac{10^3 \text{mA}}{A} = 2,51 \cdot 10^3 \Omega = 2,51 \text{k} \Omega \]

The resistance of the coil can be neglected in the resistance calculation.

Kind regards

Friedrich