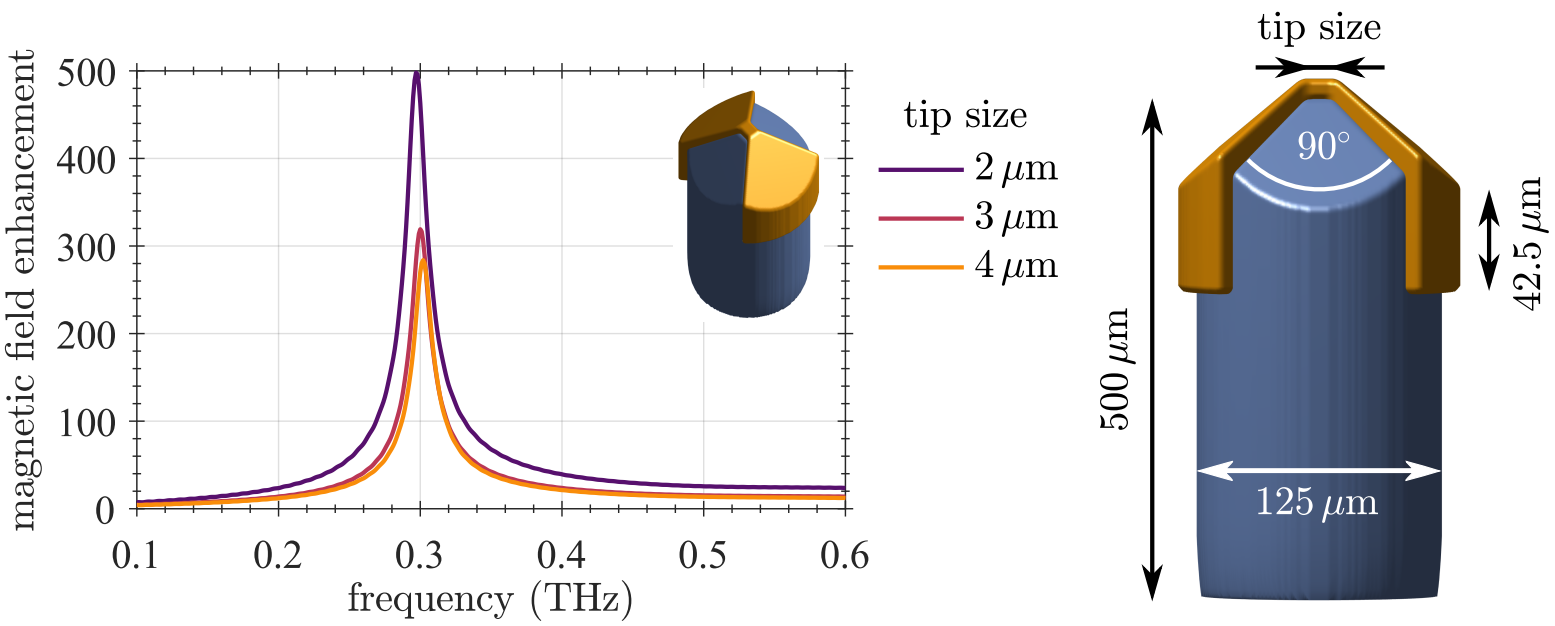
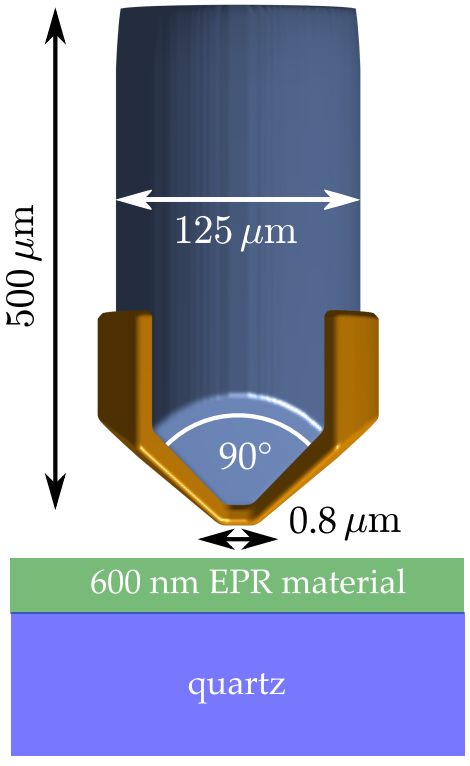
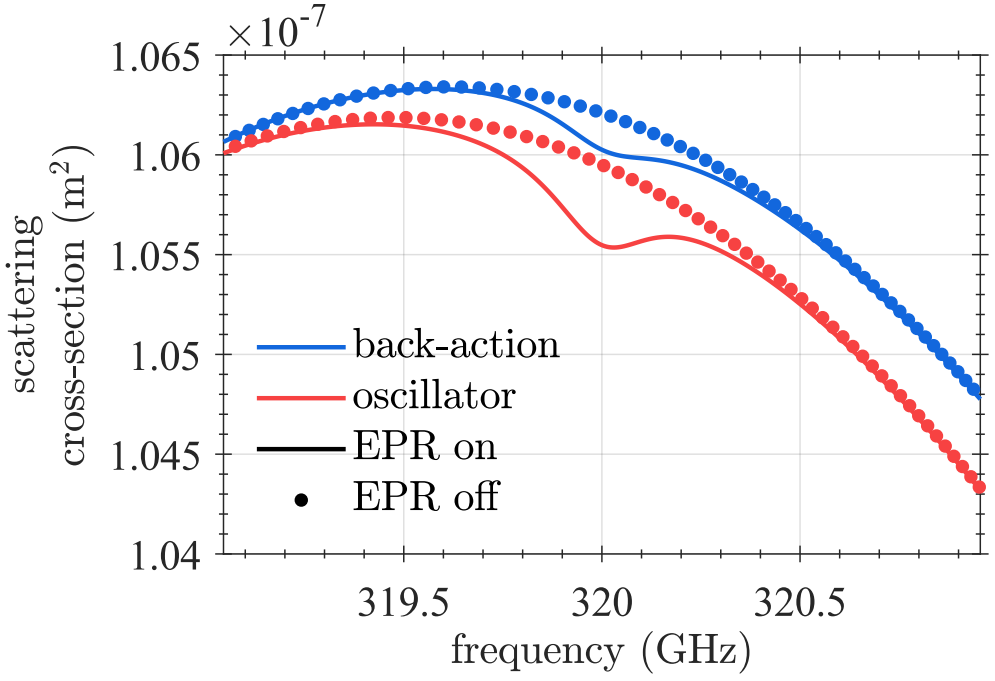

magnetic field enhancement
500
400
300
200
100
0
0.1
0.2
0.3
0.4
0.5
0.6
frequency (THz)
tip size
2 μm
3 μm
4 μm
tip size
90°
42.5 μm
500 μm
125 μm





oscillator model

$$C_{\text{sca}}^{\text{m}} = \frac{6\pi c^2}{n^2} \frac{\gamma_{\text{r}}^2 \omega^4}{\left(\omega_0^2 - \omega^2\right)^2 + \omega^2 \left[\gamma_{\text{i}} + \gamma_{\text{m}}(\omega) + \gamma_{\text{r}}\omega^2\right]^2}$$

ohmic losses | magnetic losses | radiative losses

$$\gamma_{\text{m}}(\omega) = \frac{\omega_0 n^2}{6\pi c^3} \mu''(\omega) V \eta_{\text{avg}} \frac{\left(\gamma_{\text{i}} + \gamma_{\text{r}}\omega_0^2\right)^2}{\gamma_{\text{r}}}$$

average magnetic field enhancemet

back-action model

current distribution

$$\vec{H}(\vec{r},\omega) \sim \vec{P}(\vec{r},\omega)$$

$$\vec{P}(\vec{r},\omega) = p(\omega)\vec{\mathcal{P}}(\vec{r},\omega)$$

mode spatial distribution (given by probe geometry)

electric field generated by the EPR material

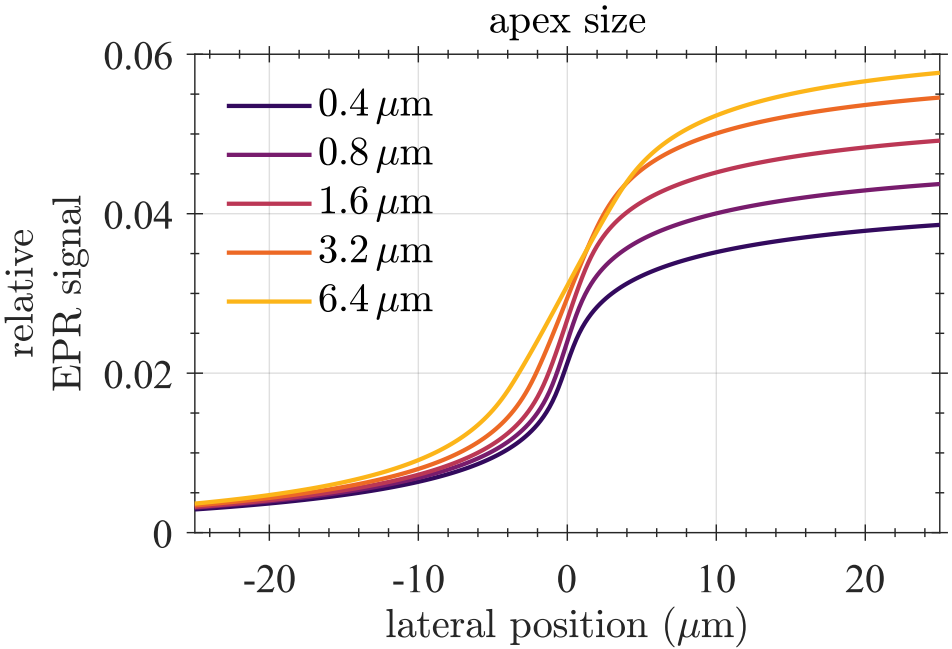
$$p(\omega) = \alpha(\omega)\left[E_0(\omega) + E_{\text{sca}}(\omega)\right]$$

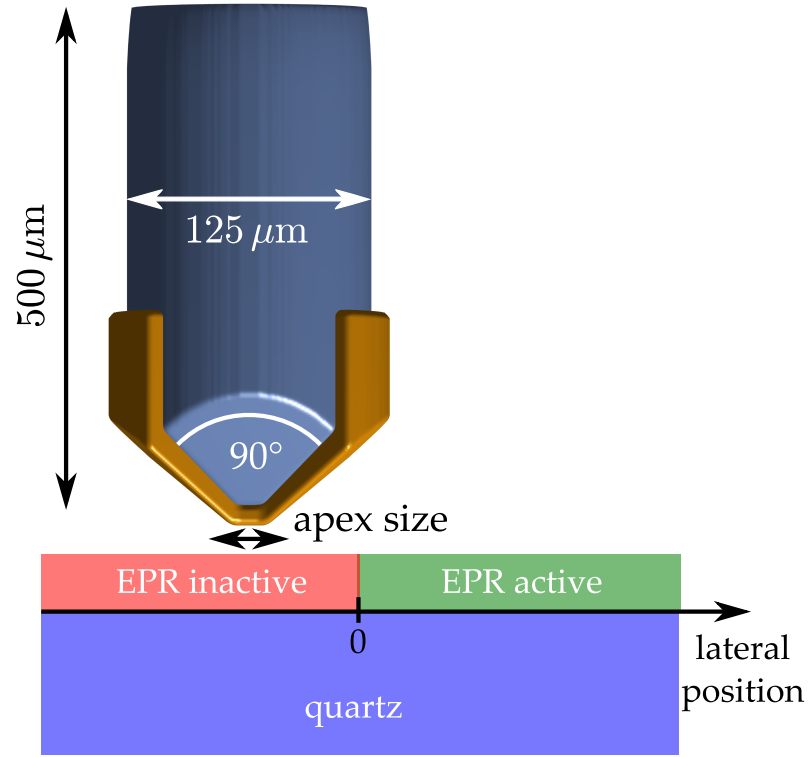
$$p(\omega) = \alpha(\omega)\left[E_0(\omega) + g(\omega)p(\omega)\right]$$

probe feedback factor

$$p(\omega) = \frac{\alpha(\omega)E_0(\omega)}{1 - \alpha(\omega)g(\omega)}$$

EPR material modulates amplitude of EM radiation emitted by the probe


apex size
0.4 μm
0.8 μm
1.6 μm
3.2 μm
6.4 μm
relative EPR signal
0.06
0.04
0.02
0
-20
-10
0
10
20
lateral position (μm)


500 μm
125 μm
90°
apex size
EPR inactive
EPR active
0
lateral position
quartz