Effective ΔH derived from measurements.

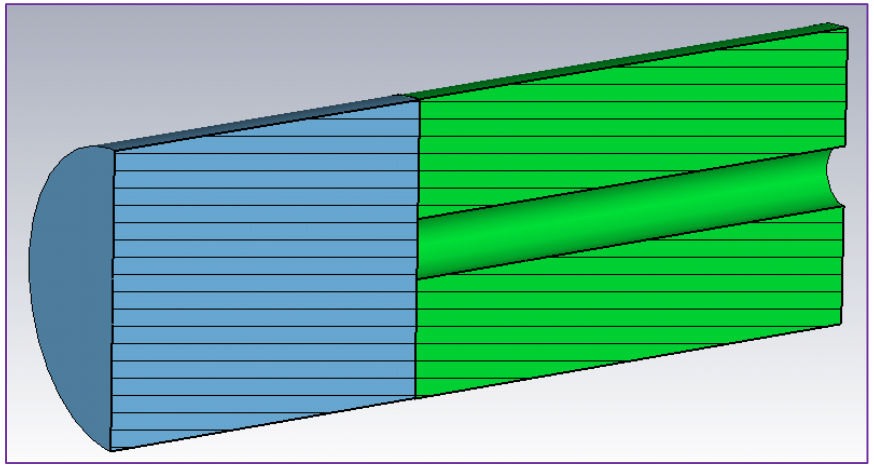
March 12, 2015

G.Romanov, Y.Terechkine,
R.Madrak, D.Sun

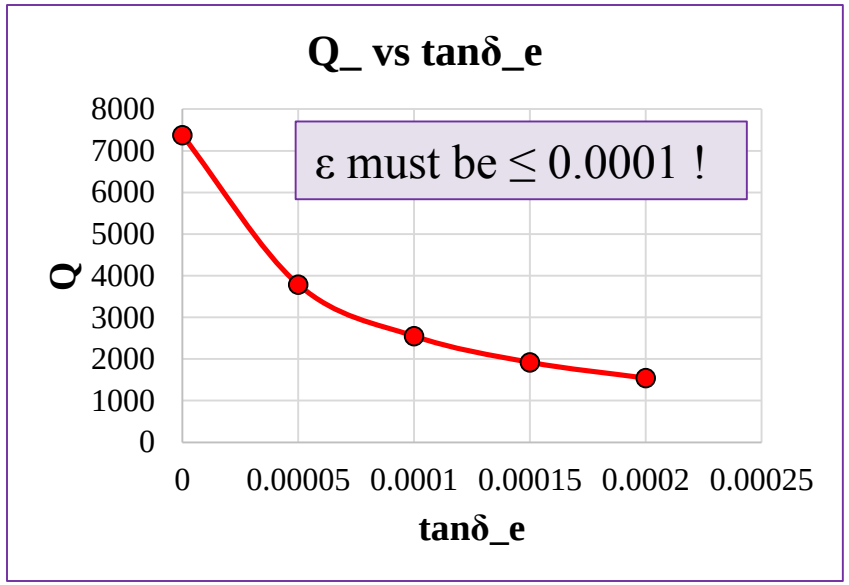
Plan from previous meeting

- ✓ Measure ε of Al800 over the 70-120 MHz interval.
- ✓ Try to check and confirm that tanδ_e=0.0002 in the 70-120 MHz interval.
- ✓ Measure static B(H) of Al800.
- ✓ Measure unloaded Q in the small solenoid set up and compare with simulations to obtain ΔH.
- Start thermal simulations with new garnet parameters.

Evaluation tanδ_e



$\mu = 2.5$, $\varepsilon_{eff} = 10.4$, tanδ_m = 0, f=128 MHz



Measurements

I	f	Qmeas	beta	Q0	H_ext	H_ext	Tanδ_m	ΔH_eff
A	MHz				A/m	Oe		Oe
30.02171	76.859	144	0	144	17862.94	224.4723	6.77E-03	62.8
35.0805	84.054	451	0.000576	451.5192	20872.92	262.2969	2.03E-03	19.9
40.13929	90.208	900	0.010937	919.6863	23882.91	300.1214	8.92E-04	9.3
50.1066	99.909	1757	0.006908	1781.273	29813.46	374.647	0.000356	4.2
80.1588	118.963	2555	0.033375	2725.547	47694.55	599.3473	0.000131	2.07

$$\frac{1}{Q_{\exp}} = \frac{1}{Q_{copper}} + \tan\delta_E + \tan\delta_M$$

$$Q_{copper}(\mu) \text{ at } \tan\delta_E = \tan\delta_M = 0 \text{ and } \varepsilon_{eff} = 10.4$$

$$\tan\delta_M = \frac{\alpha \cdot \omega \cdot 4\pi M_s}{g\left(H_{ext} - 4\pi M_s\right)H_{ext}}$$

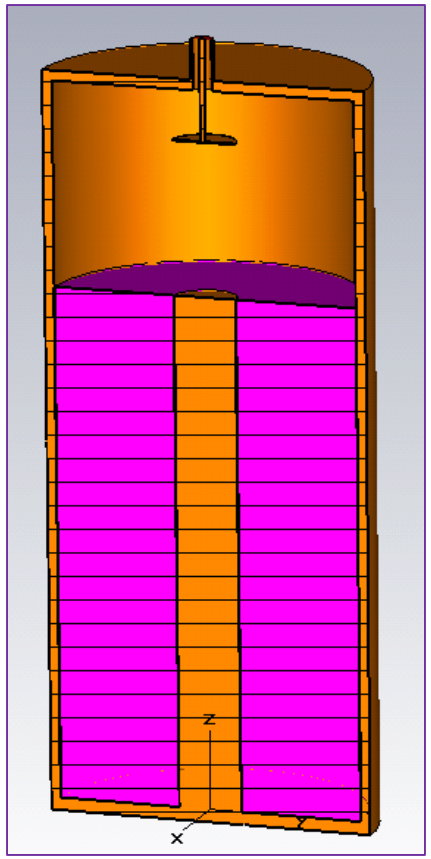
$\alpha = g\Delta H/2\omega$

$$\Delta H_{eff} = \frac{\tan\delta_M \omega_0^2 H_{ext}}{g\omega 4\pi M_s}$$

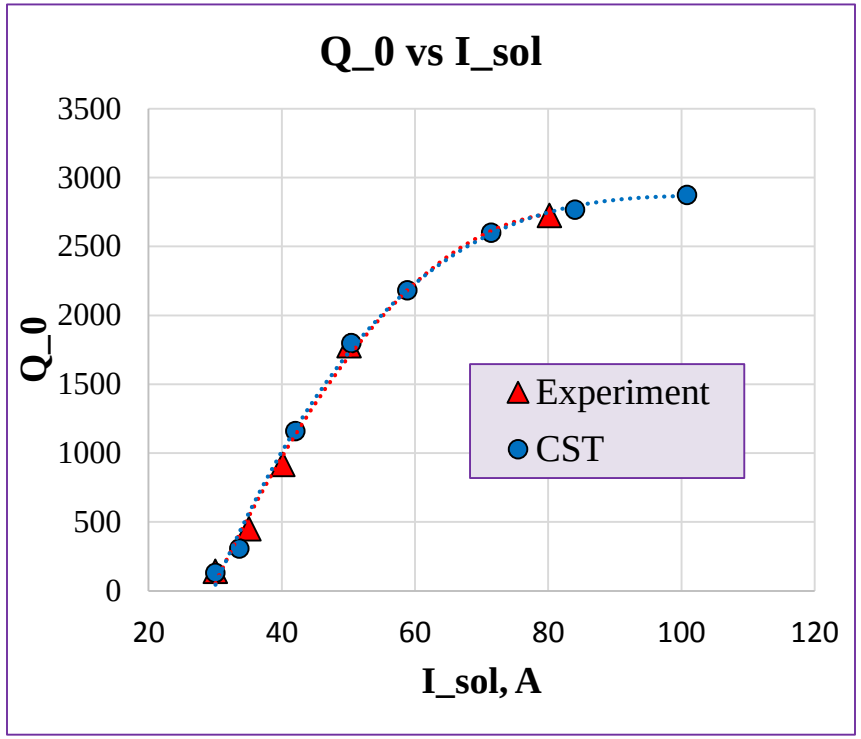
For now

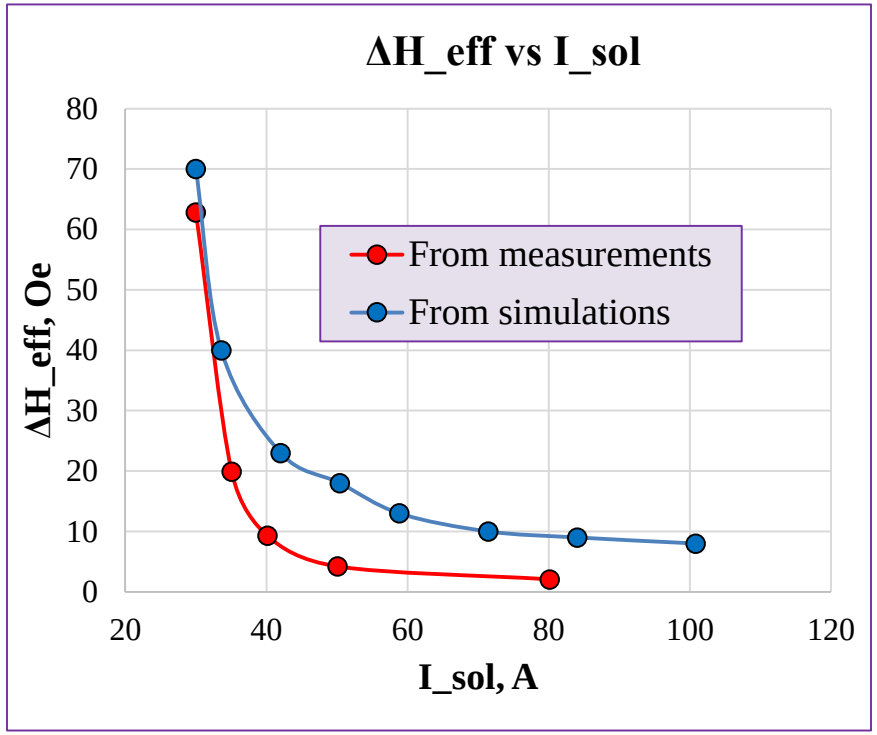
$$\omega_0 = 9.4\,\text{GHz}$$

Model of the set up



B(H) – version 4
ε = 10.4
Uniform H_ext
(no solenoid)





At given H_ext (Oe) = 7.477*I_sol (A) value of ΔH_eff was scanned to fit measured Q_0.

More accurate table with smaller steps will be prepared for future simulations.