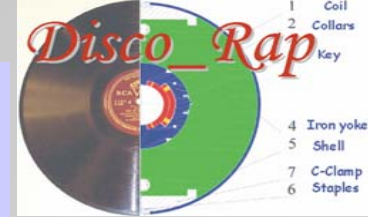


Short resume on magnetic measurements of NbTi wires

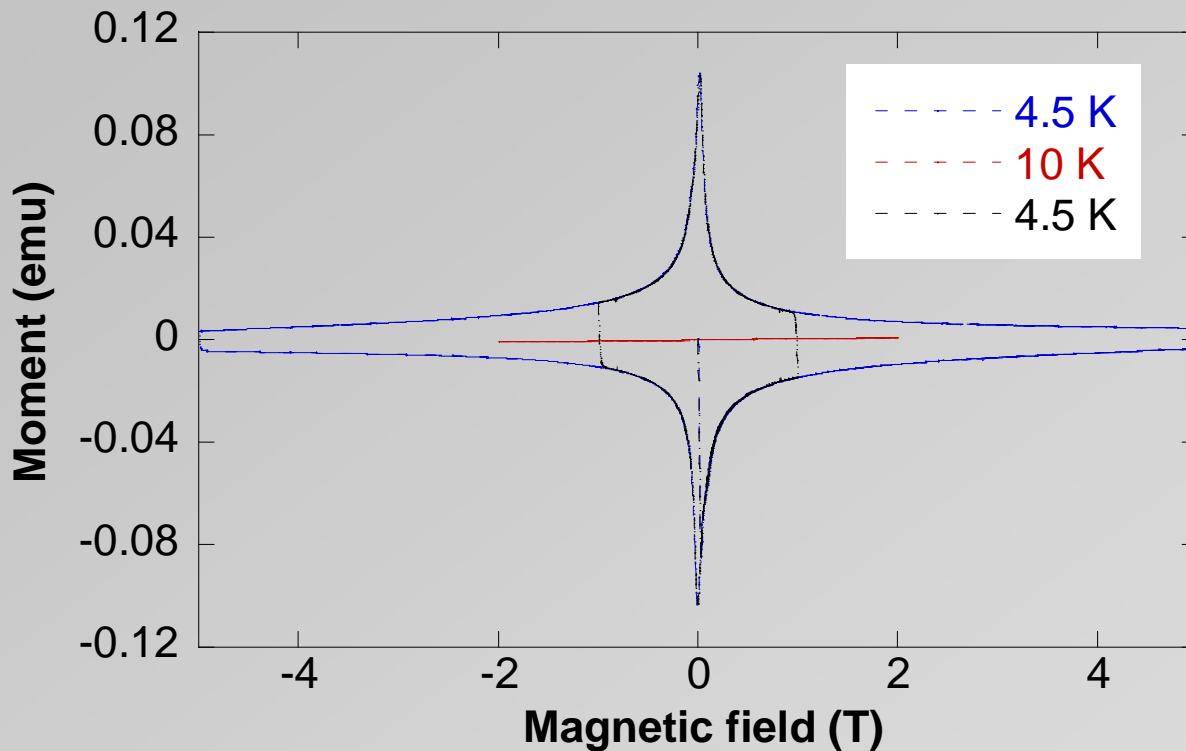


Here we wish to summarize results on NbTi wires made of thin filaments.

M(H) curves were recorded with different magnetometers (VSM 12T, VSM 16 T, 5T SQUID Magnetometer), which have been cross checked against the calibrations.

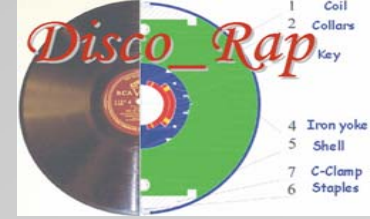


In practical measurement for a NbTi wire we expect a symmetric curve with respect the x axis. Of course our measure includes the sample holder.

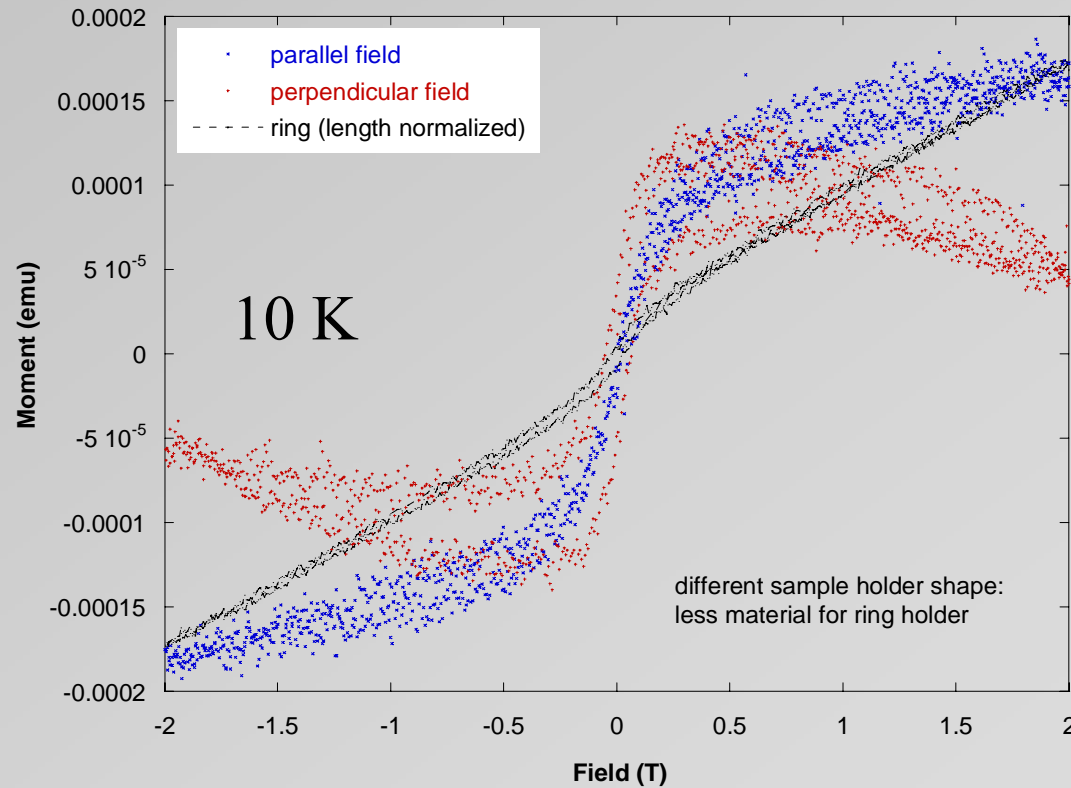
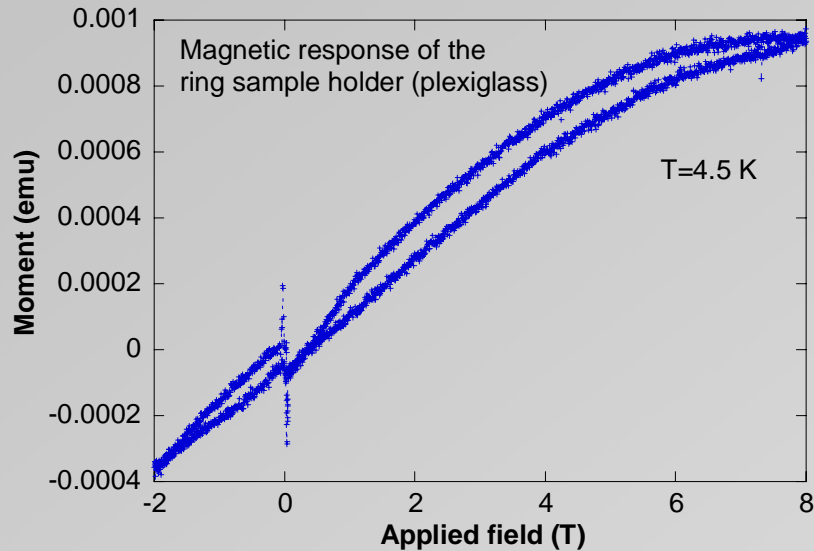


Nb Ti wire F6264 (sep.
2006)
D=0.5mm L=3.7mm





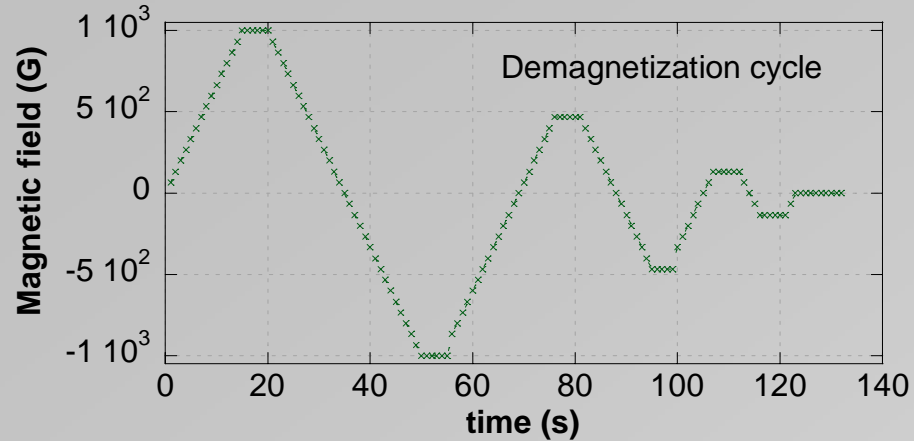
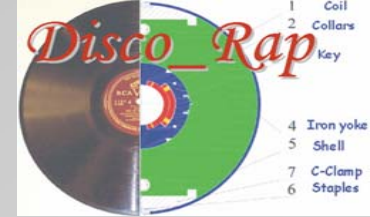
Wire + sample holder →



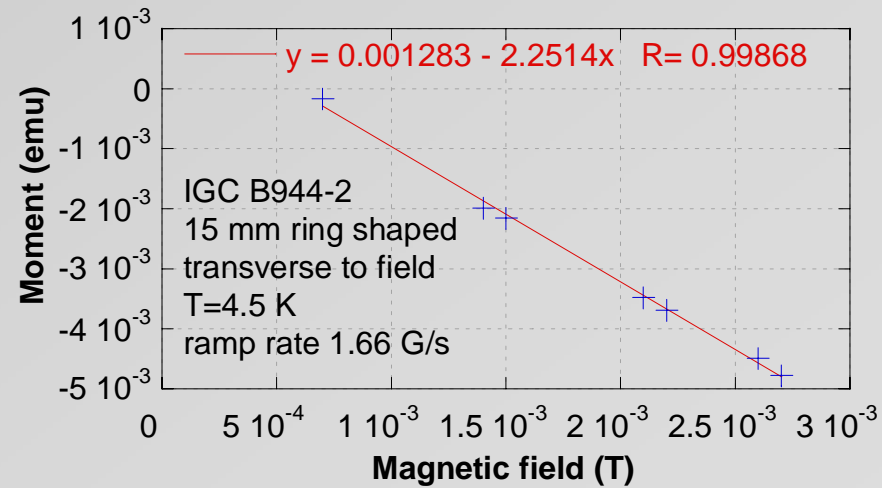
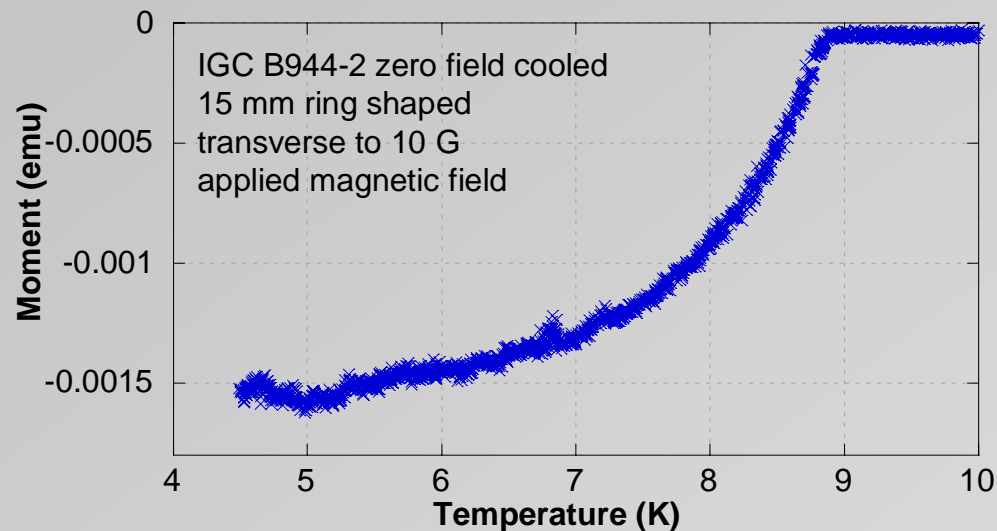
← sample holder



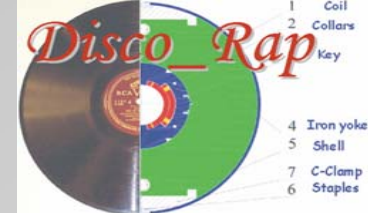
The shielded volume low field measure



To achieve low field the magnet itself has to be demagnetized



Limits arising from very thin filaments



When using standard $V_{\text{shield}} = m/(\chi_0 B)$ the ratio λ/d_{fil} should be negligible to avoid large errors: *e.g.* for sample SL 86969 ($d_{\text{fil}}=2.5 \mu\text{m}$) in 10 G we had $V_{\text{shield}}=0.753 \text{ mm}^3$ while the wire section is 2.87 mm^3 and $\alpha=1.55$ thus $V_{\text{nominal}}= 1.131 \text{ mm}^3$.

For Luvata 1 wire we found $SC=0.45 \text{ mm}^3$ to be compared to $SC_{\text{nominal}}= 0.64 \text{ mm}^3$

χ_0 must be corrected
according to R/λ ratio
but $\lambda(T)$ has to be determined

$$\chi_0 = \left[1 - \frac{2\lambda}{R} \frac{\frac{1}{\pi} \int_0^{\pi} e^{R/\lambda \cos t} \cos t \, dt}{\frac{1}{\pi} \int_0^{\pi} e^{R/\lambda \cos t} \, dt} \right]$$



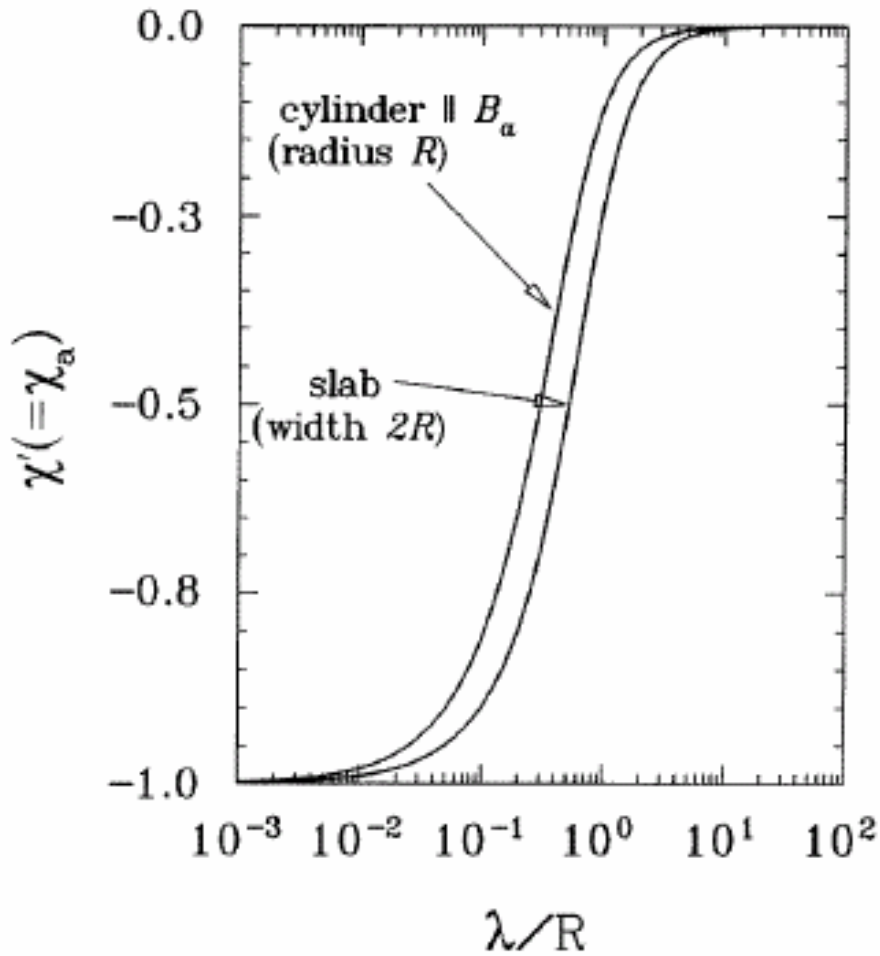
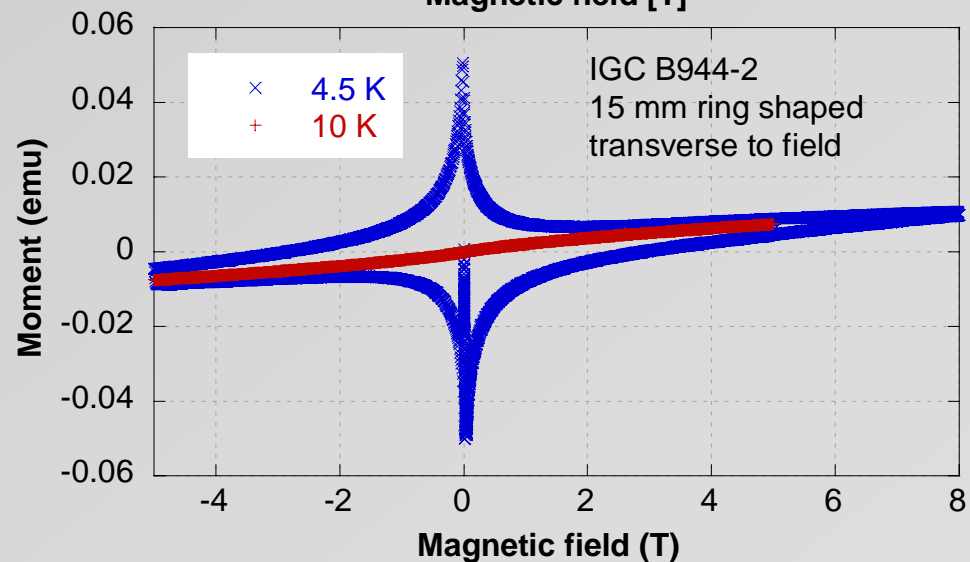
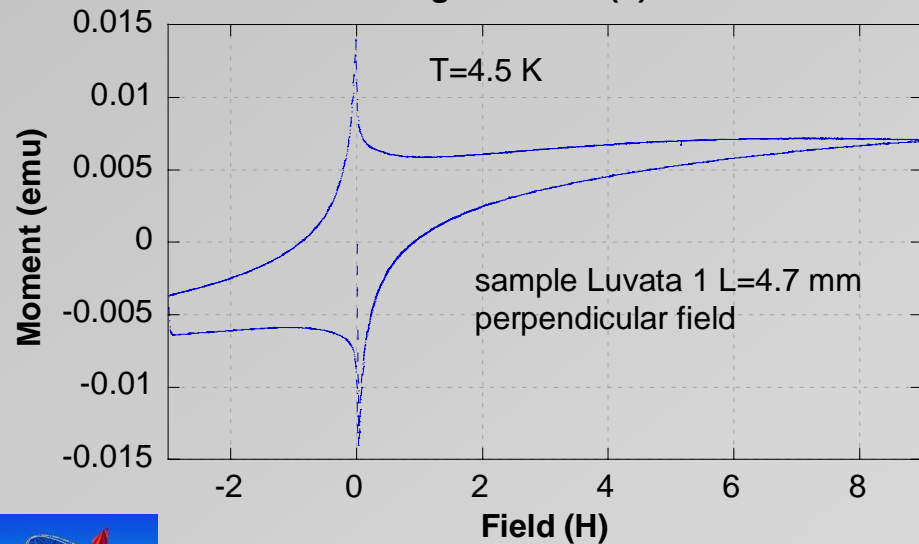
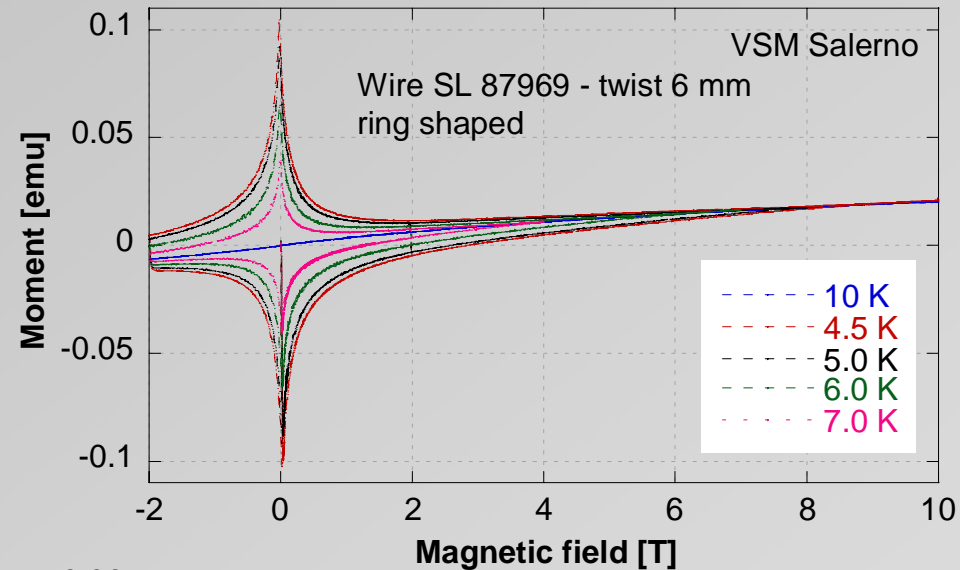
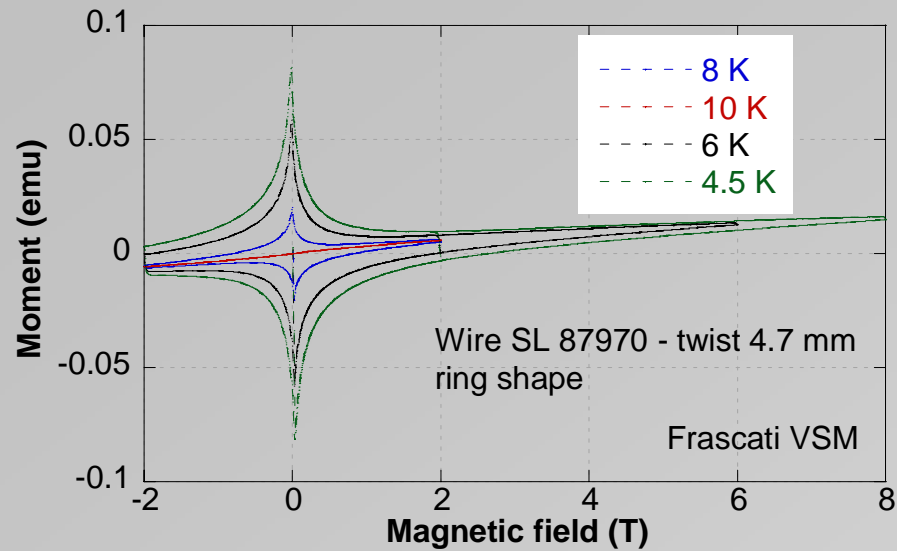
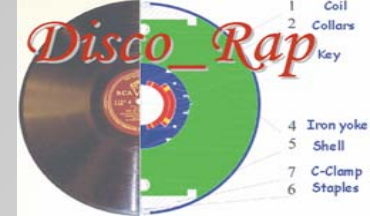


Figure 5. AC susceptibility in the regime of reversible screening.

Fedor Gomory
 SuST **10** (1997) 523–542



The presence of CuMn



Deconvolution of contributions



It is not a simple task, as the signal comes from:

1. the reversible magnetization of the specimen
2. the paramagnetism of Mn
3. the sample holder contribution

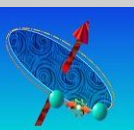
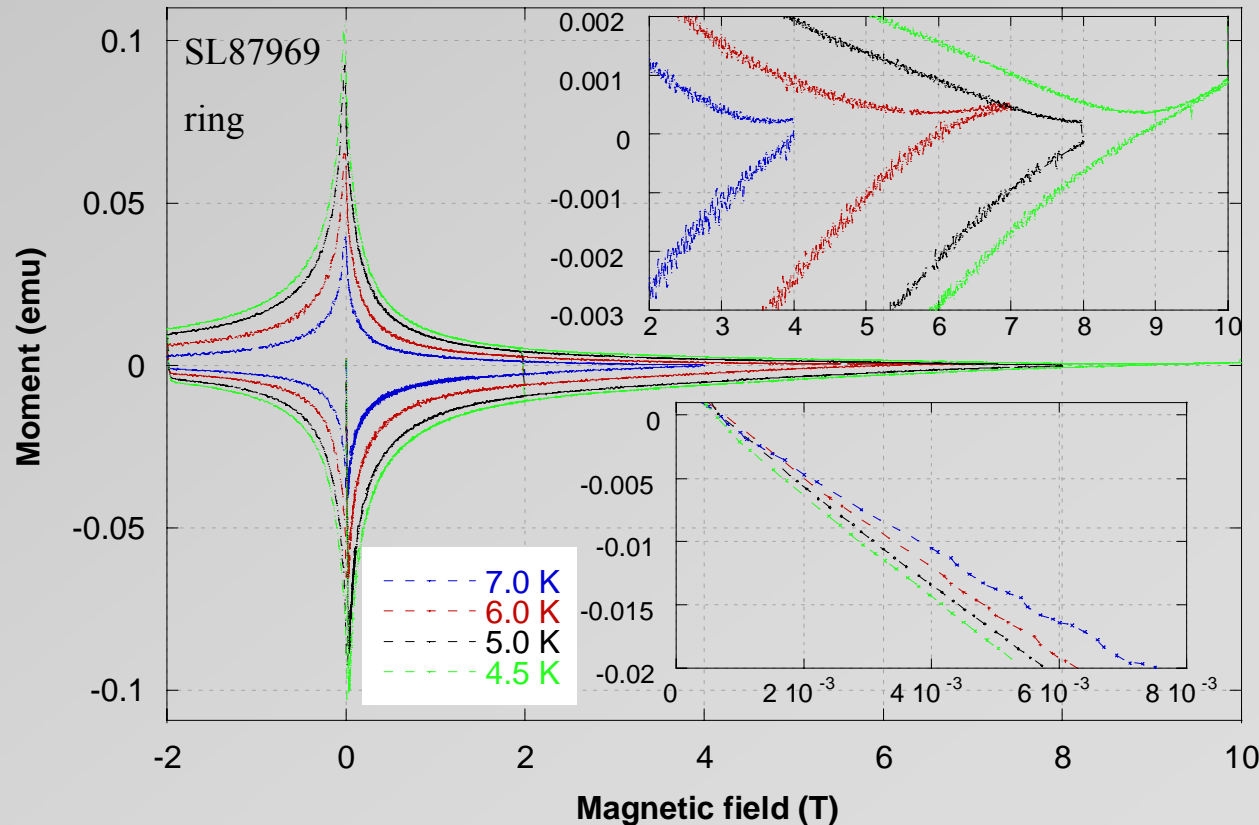
At $H_{c1} \ll H < H_{c2}$

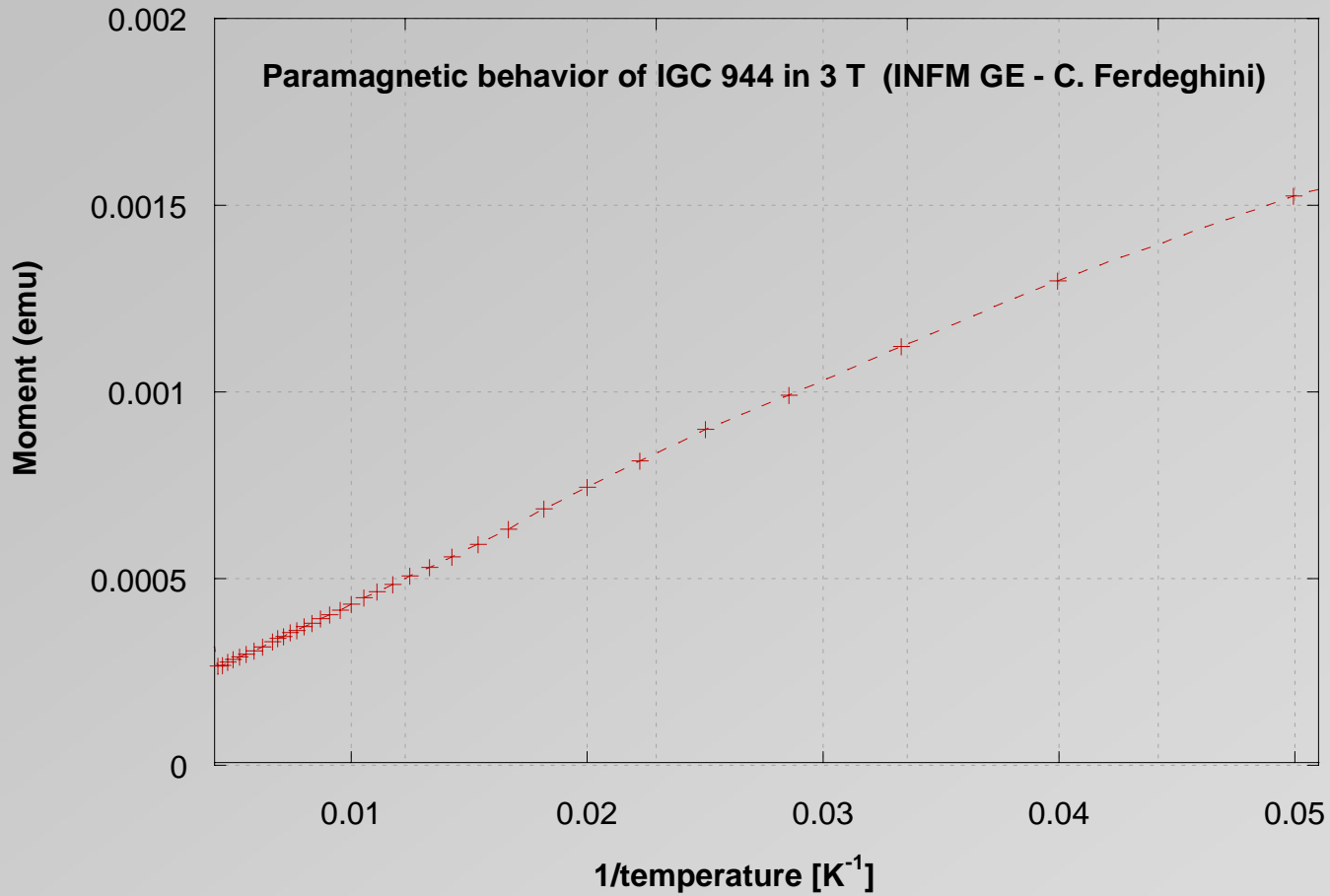
$$\frac{dM}{dH} = \frac{1}{4\pi\beta_a(2\kappa^2(T)-1)}$$

$$\kappa = \frac{1}{\sqrt{2}} \frac{H_{c2}}{H_c}$$

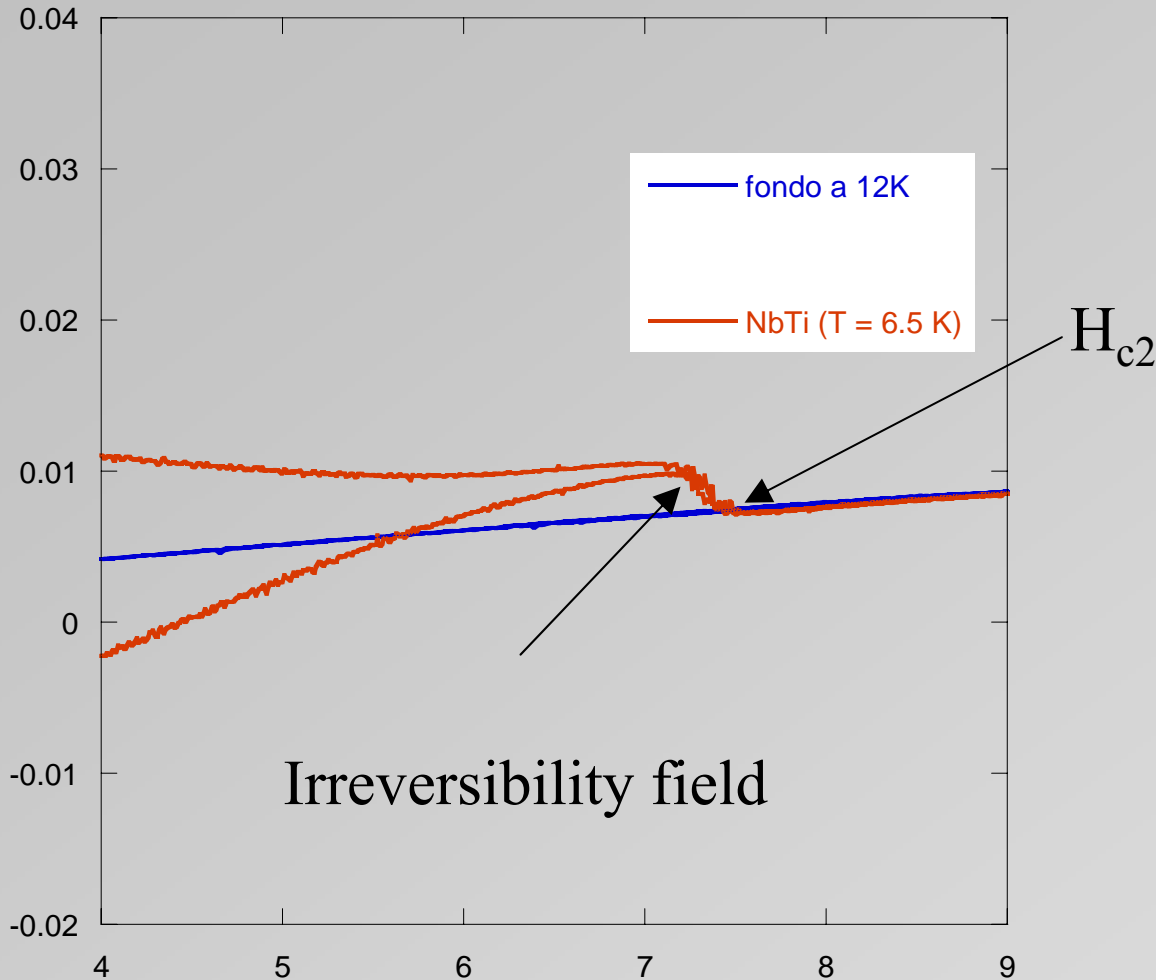
At $H \ll H_{c1}$

dM/dH vs T from ZFC may be used to estimate $\lambda(T)$



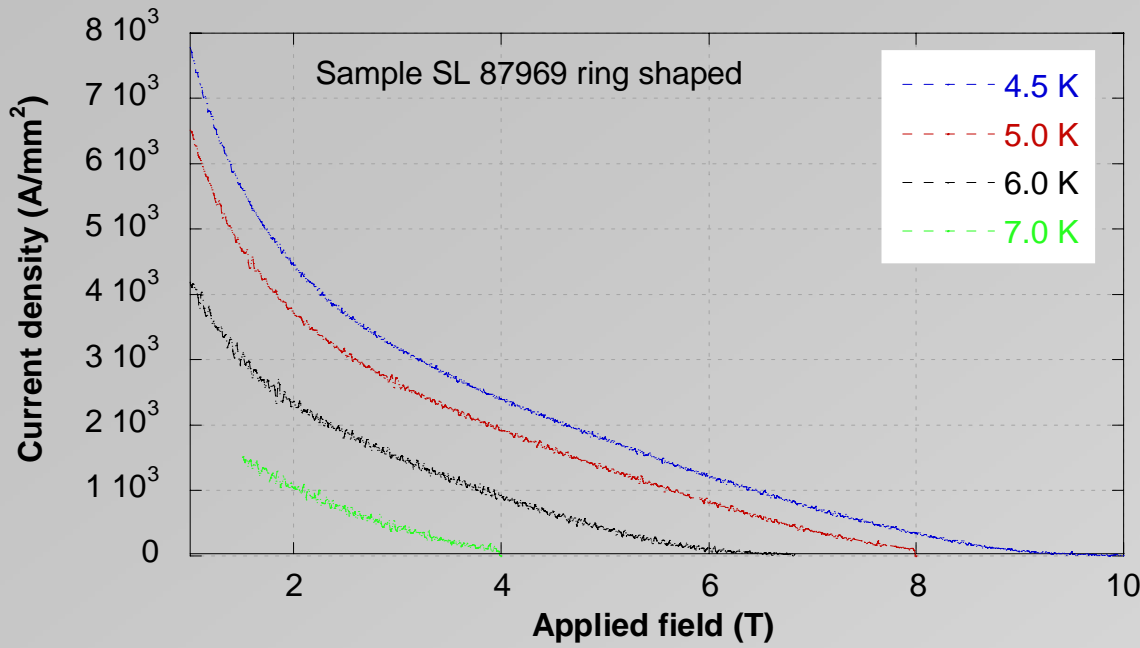


Other fundamental properties



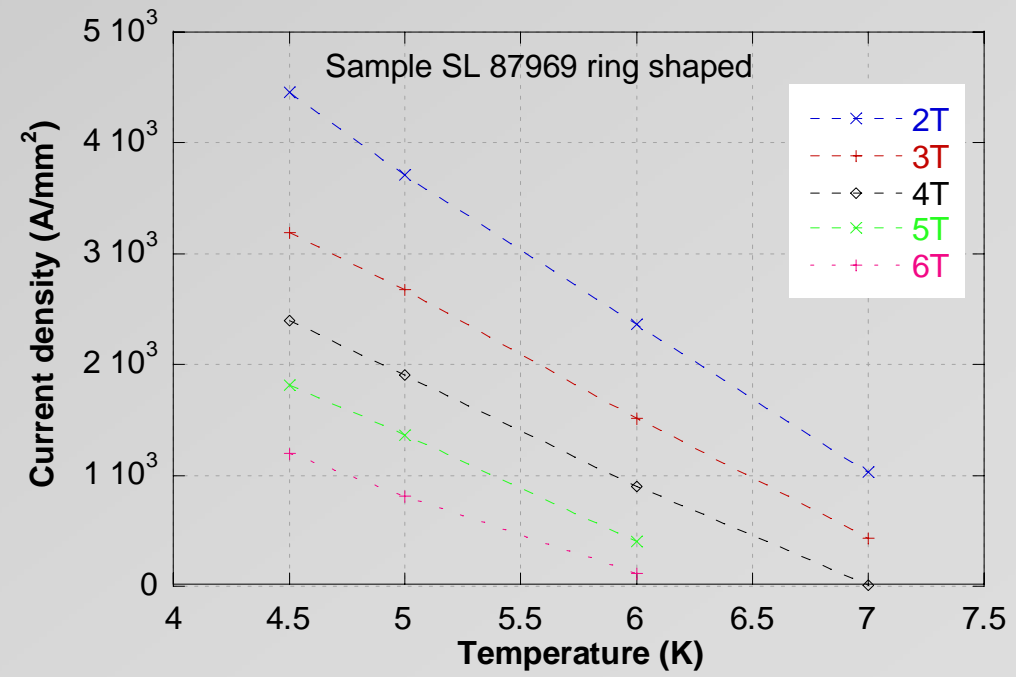
Luvata NbTi wire,
6 μm filaments, 18
mm ring shape
measured at 6.5K



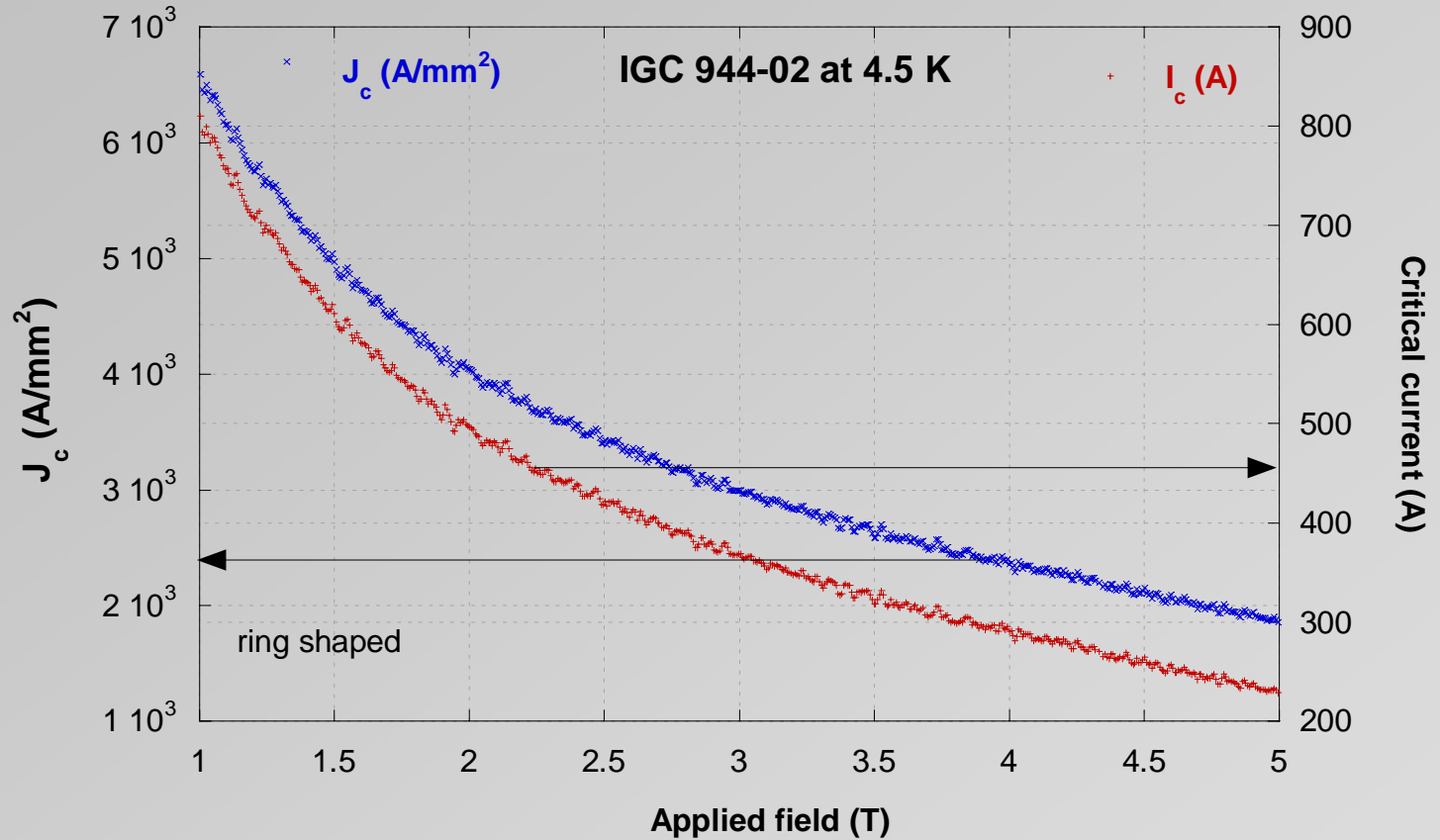
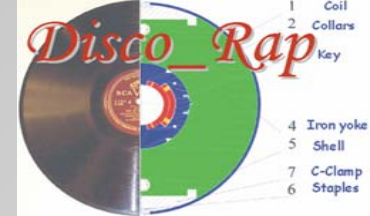


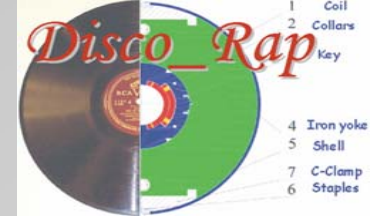
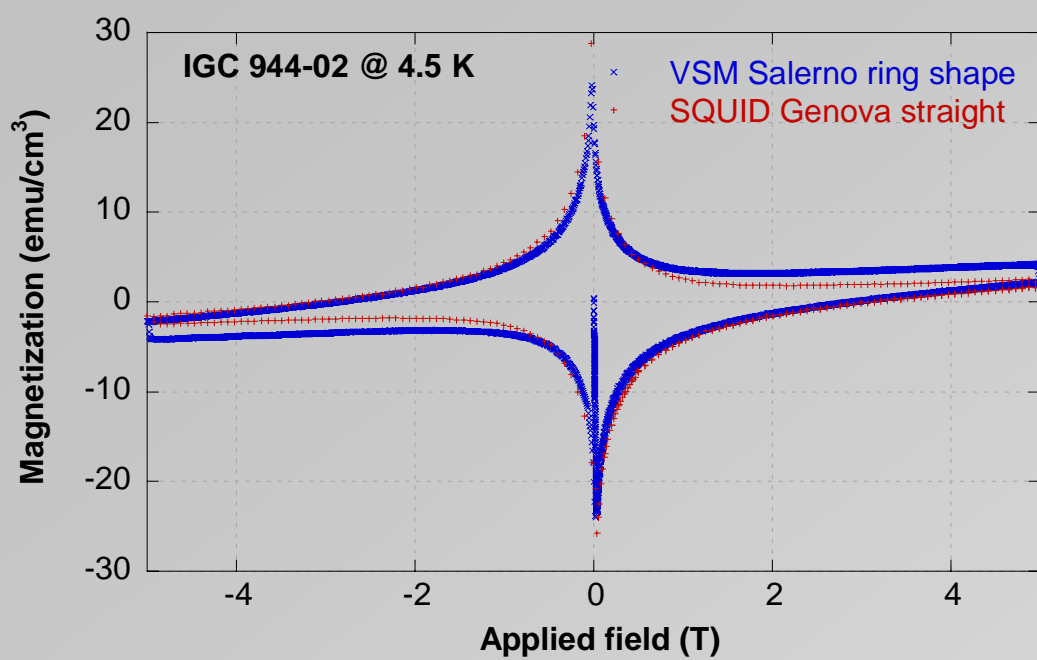
SL 87969 wire

Critical current density as derived from magnetization measurements in a 17mm long wire ring shaped

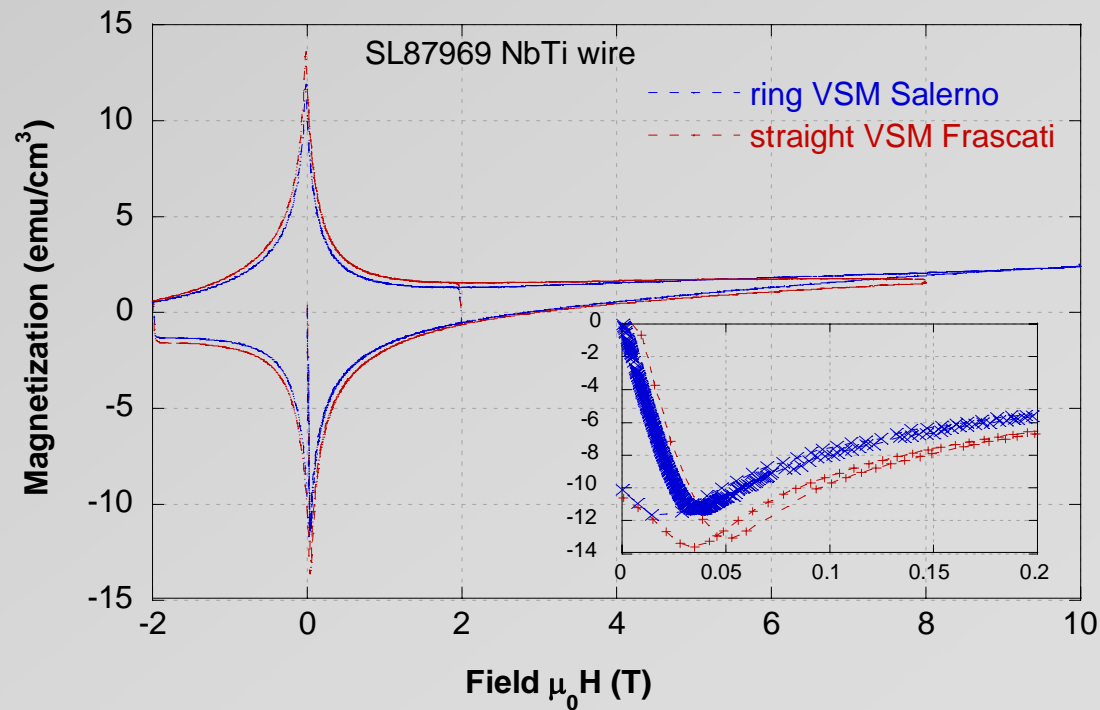


Critical currents in IGC B944-03

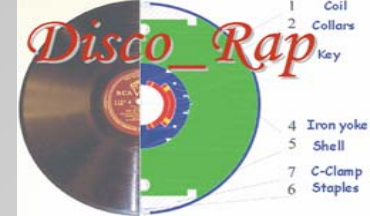




Comparison among different magnetometers



Losses & filaments coupling



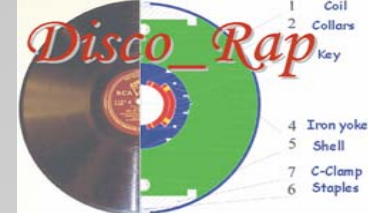
$$Q_{mag} = \oint m(B) dB$$

In the IGC 944 wire we have $Q_{mag} \approx 1.23 \cdot 10^{-1}$ mJ in a ± 5 T cycle

or $Q_{mag} \approx 58.5$ mJ/cm³ in a ± 5 T cycle



Cycles $4 \pm 0.5T$ at different ramp rates (Frascati VSM only)



Luvata $6 \mu\text{m}$ NbTi wire

$$Q_c = \frac{B_m^2}{2\mu_0} \frac{8\tau}{T_m} \quad (\text{cfr. Wilson 8.53})$$

$$n\tau = 11.2 \text{ ms @ } 4.8\text{K}$$

$$n\tau = 10.7 \text{ ms @ } 6.0\text{K}$$

($n\tau = 6.8 \text{ ms @ } 5.0\text{K}$,
ref. Gislou *et al.*, IEEE 2003)

AC losses
NbTi Sn-Ag coating

