Institute of Electrical Engineering SAS

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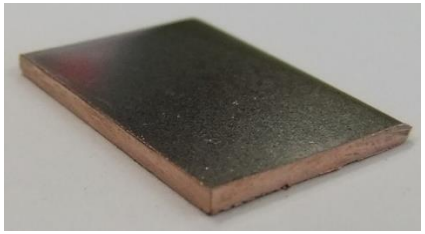
SC characterization at IEE Bratislava results, status

ARIES WP15 Y1 meeting, Riga, 22 May 2018

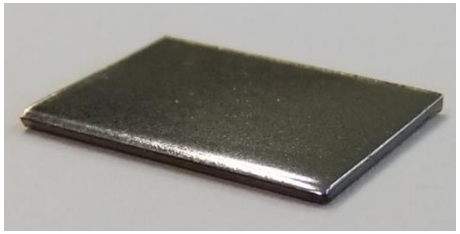
Samples tested at IEE

C10 ; L8 ; L16 ; L20 ; L21 – received from INFN Legnaro

C1 ; *L1* ; L10 ; L9 ; L23 – received from Uni Siegen pieces ~ 12 x 17 mm



2 edges cut @ Legnaro



2 edges covered w. Nb

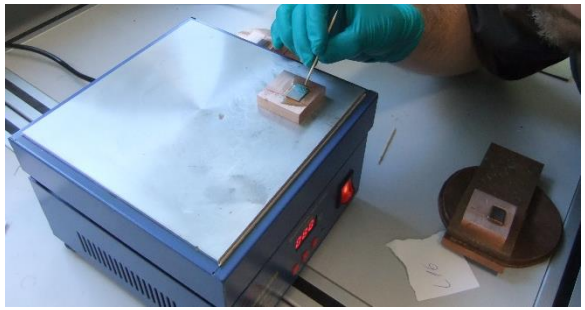
Samples for measurements (in PPMS) cut with “Diamond” saw

– circular saw, SiC cut-off disk used

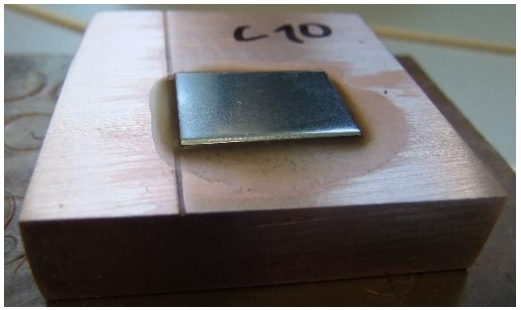
– water-based cooling liquid

Master samples “glued” to Cu support blocks with Bee-wax / Colophony mixture (~ 2:1)

C10 and **L16** – Nb layer covered with bee-wax (thin layer) for protection @ cutting

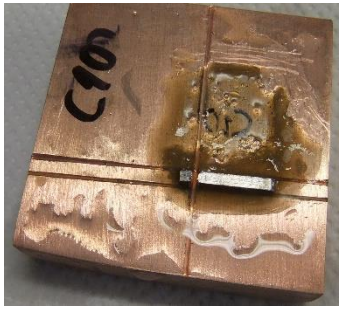


melting ~80 °C (pure bee-wax ~60 °C)

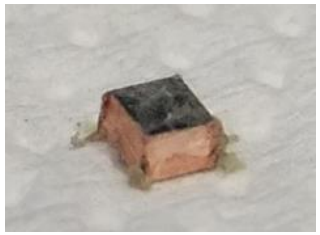


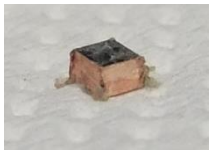
Cu blocks 5x5x1 cm

After cutting a line whole area was flushed with Ethanol, dried

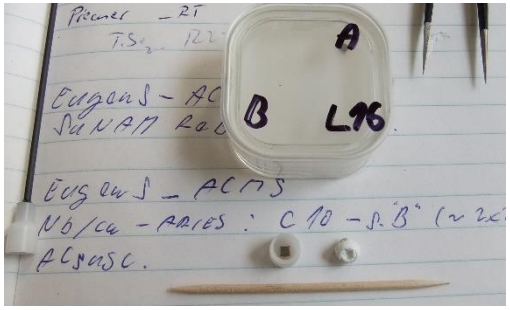


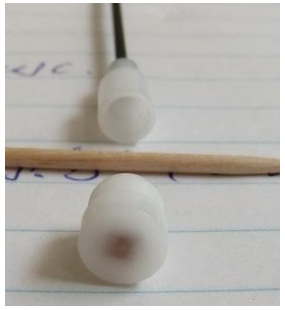
Produced samples ~ 2x2 mm, OK for both AC susc. and VSM in PPMS

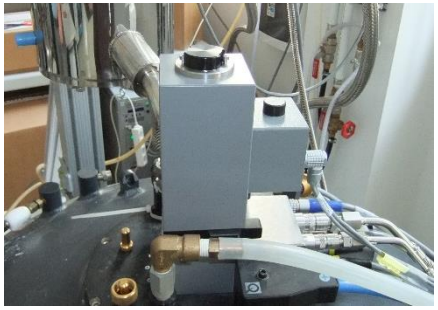




Mounting in sample holder of AC susceptometer (ACMS)







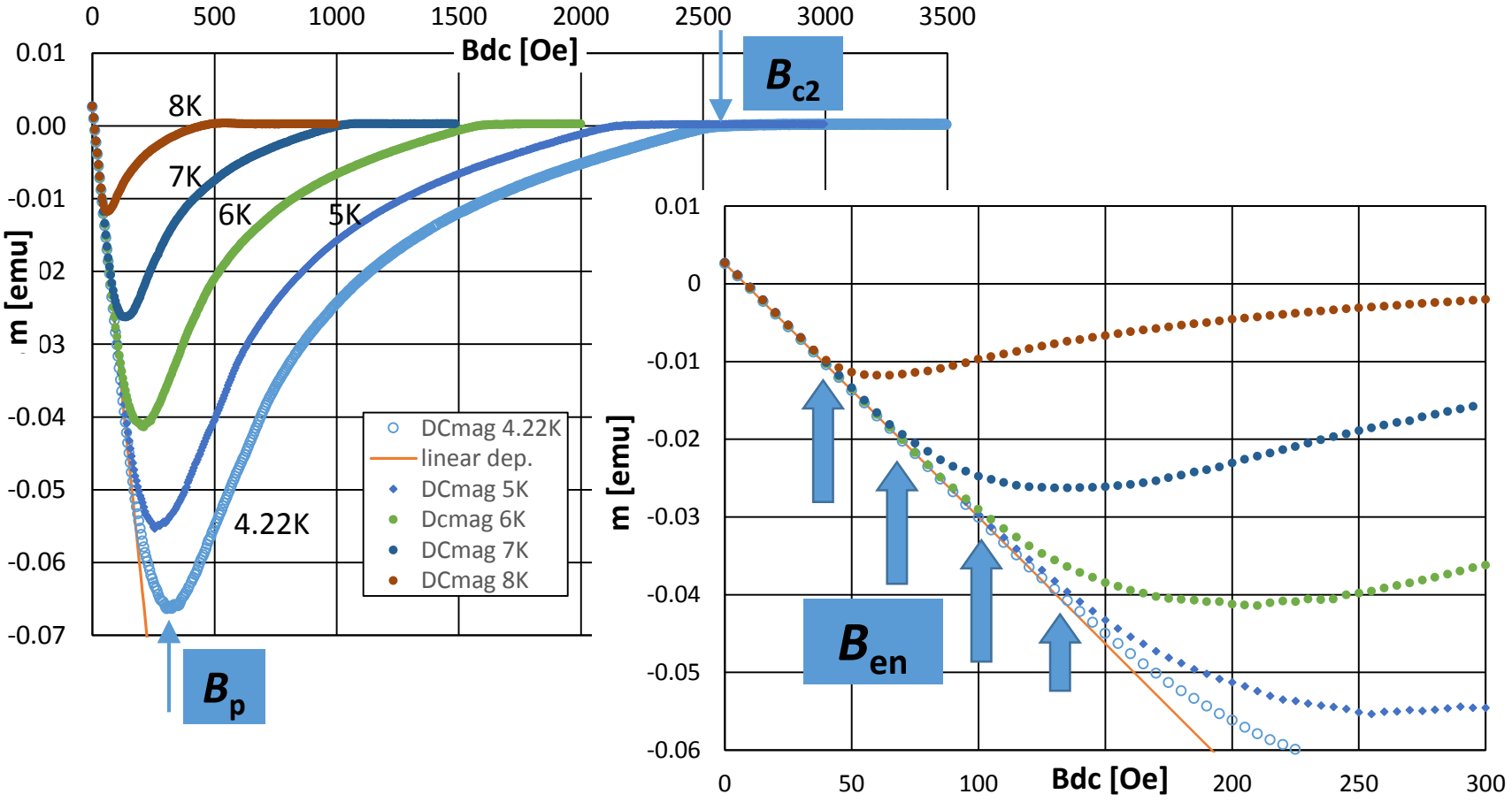
For measurements in perpendicular applied field

SC Characterisation results

DC magnetization

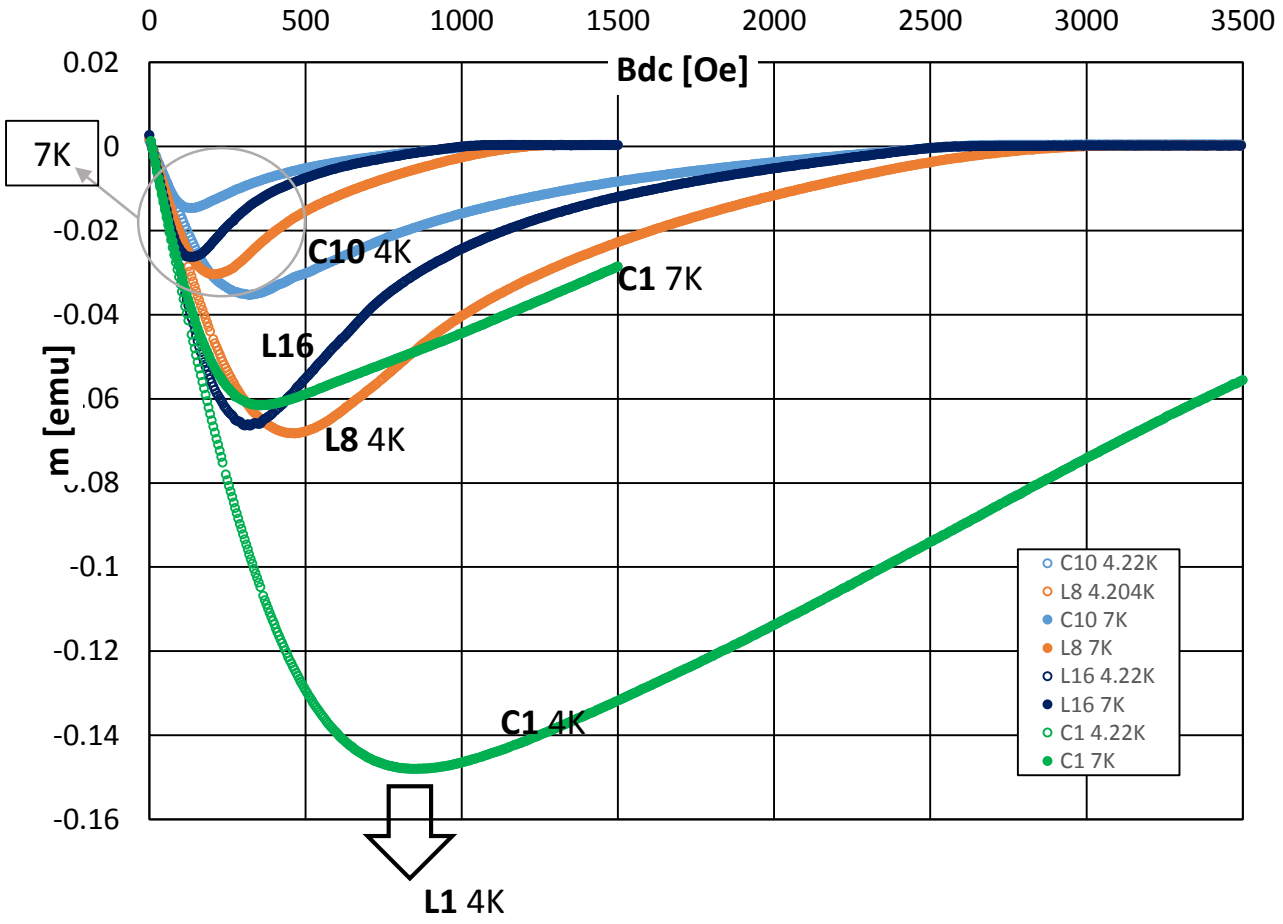
– virgin mag. curve: B_{en} (~B_{c1} perp.), [B_p, B_{c2}]

sample **L16** (example):



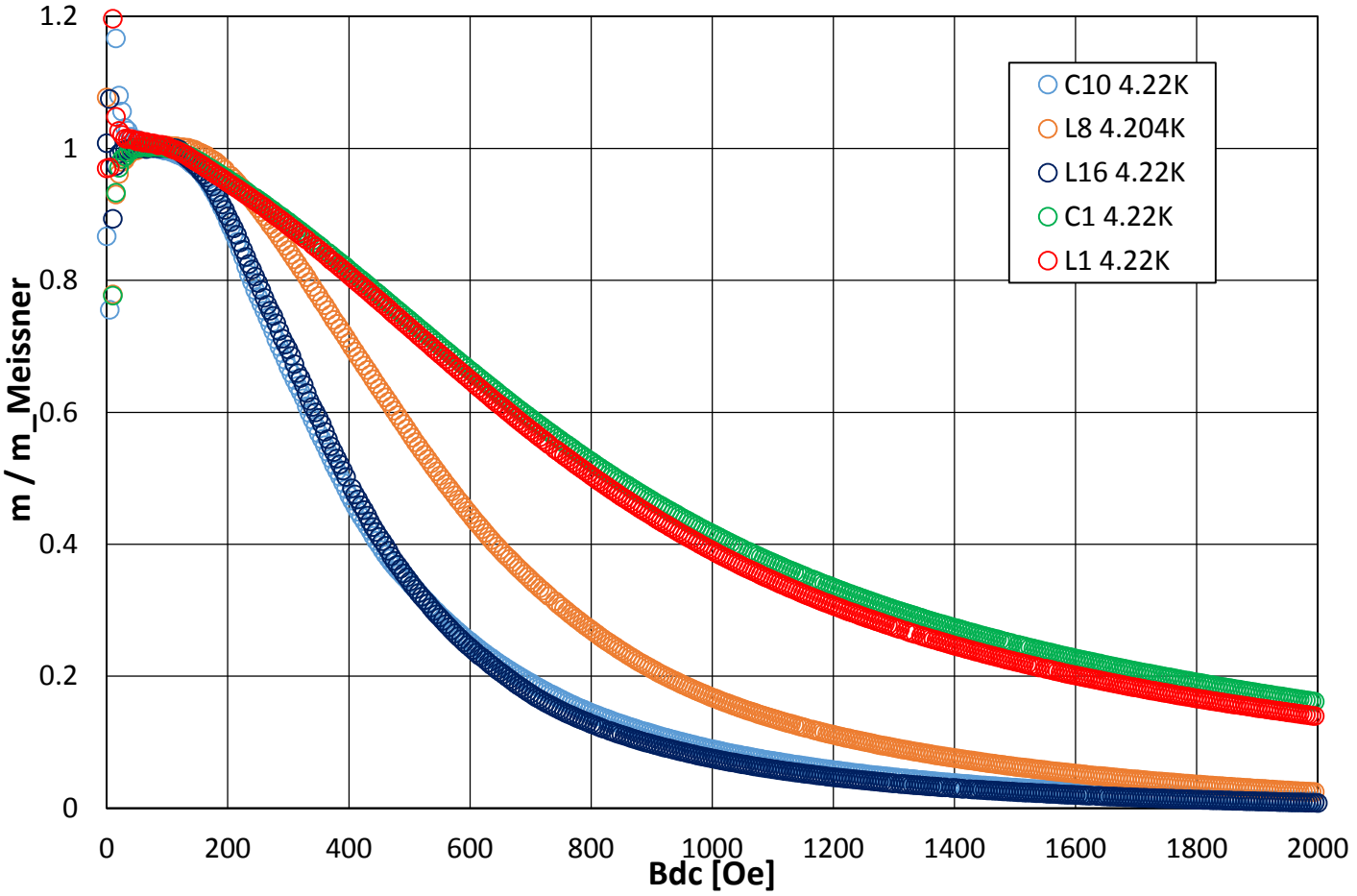
Comparison of samples

virgin mag. curves:

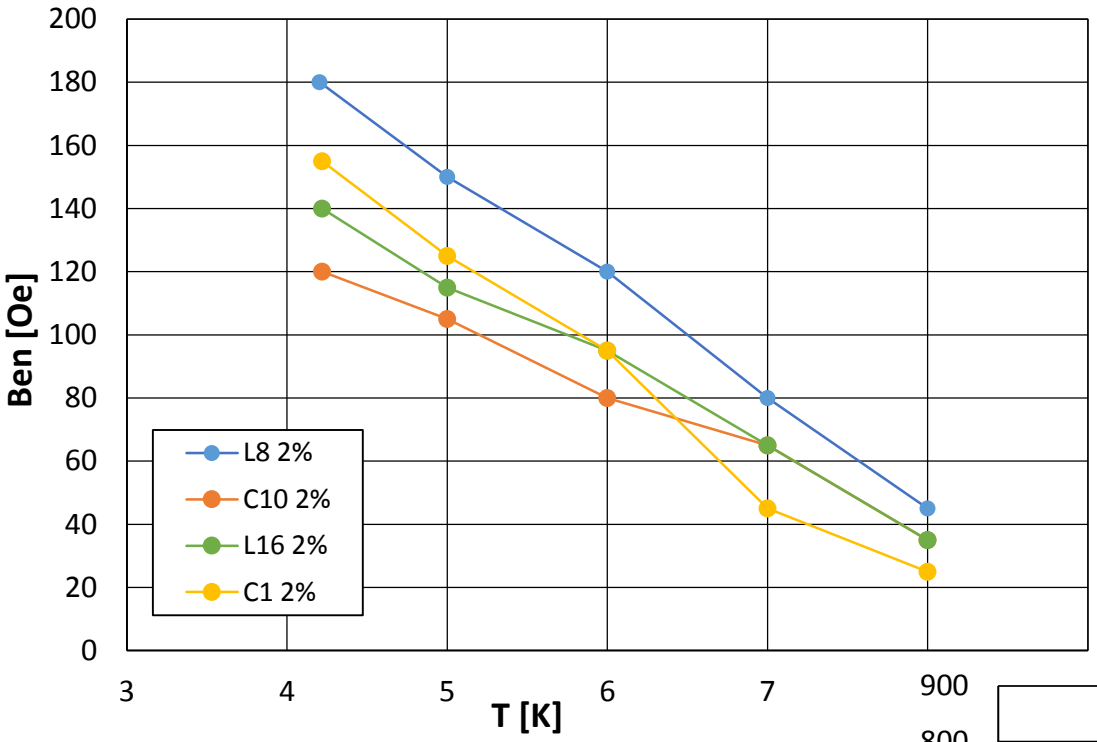


Virgin curves normalized to the linear fit of the initial (Meissner) part

*m*_Meissner = A * *B*dc + B



Flux entry field B_{en} (proportional to B_{c1})

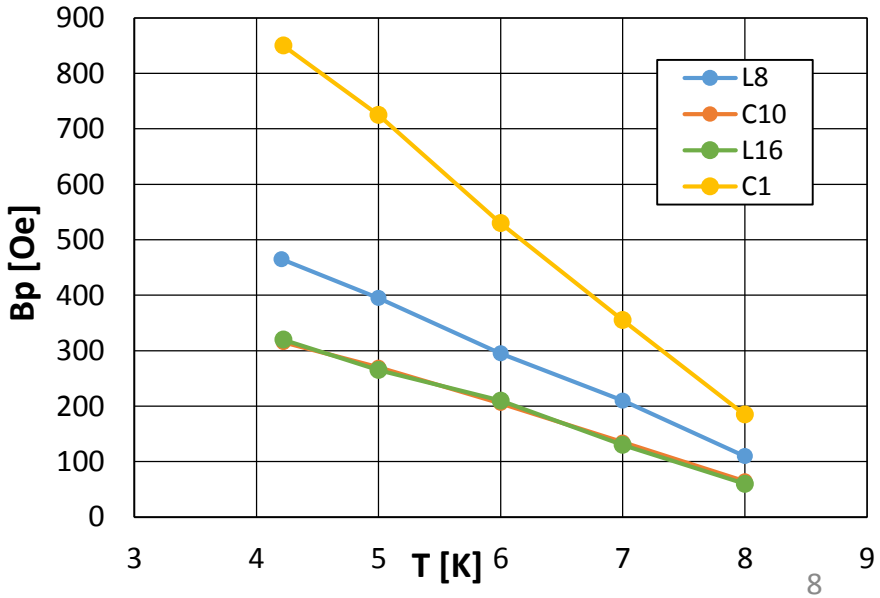


Brandt, general aspect ratio:

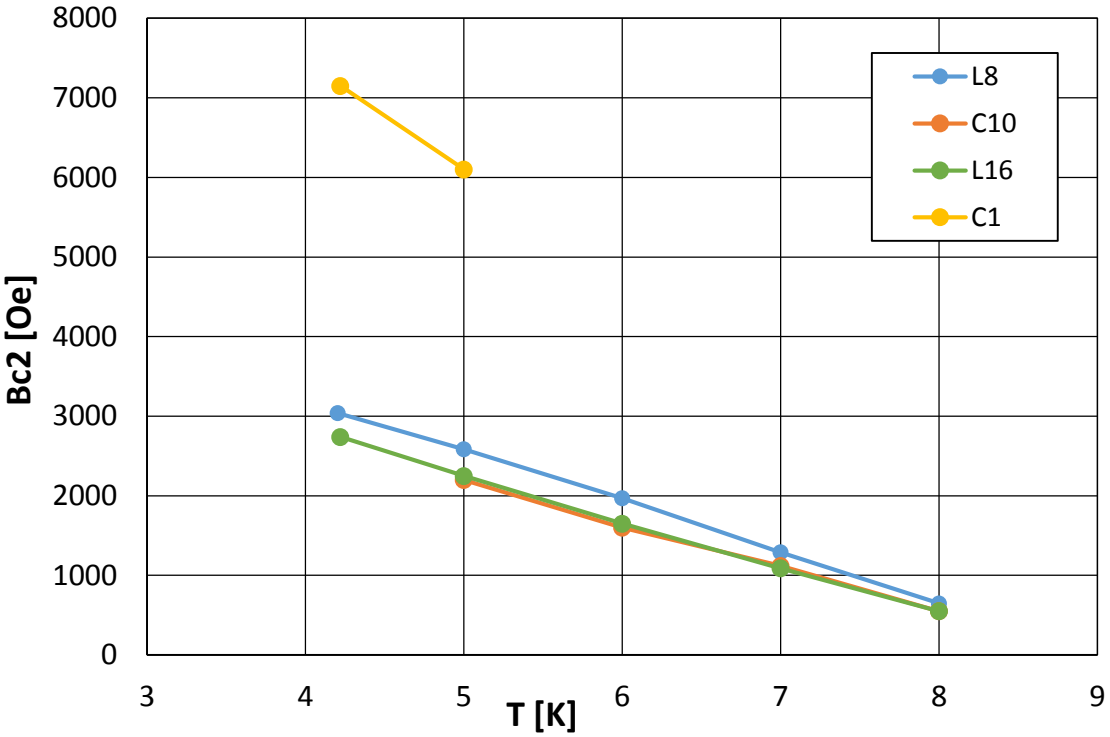
$B_{en} / B_{c1} \sim \tanh(\sqrt{0.36}\, t/w)$

Does not work reasonably for our samples (Bc1 ~ 500mT)

"Full penetration" field B_p



Upper critical field B_{c2}



To compare the different samples more properly – **Thickness**

Do we know the Nb thickness for the samples?

New set-up for **3rd harmonic voltage measurement** – Still in preparation …

- Small AC coil (ø~mm) close to big (~cm's) flat sample – thin film
- *B* || surface, edge effects negligible

Sample holder prepared

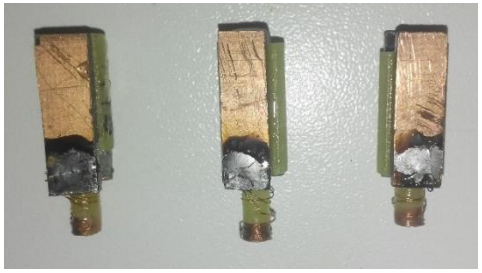
Electronic circuit tested, better amplifier necessary

→ "A" type amplifier acquired (17.5.)

→ Splitting field generation & 3f voltage detection

2 mini-coils, passive filter after amplifier

Cu **mini-coils**: inner *d* = 1.25 mm
outer *d* = 3.45 mm
height *h* = 2.2 mm
turns *N* = 235



Thank you

for your attention