Magnetic Field Penetration Facility:

Update / Liam Smith, Oleg Malyshev, Dan Seal.

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Outlook

1 Magnetic Field Penetration Facility

- Aims of Upgrade.
- Upgrade Status.

3 The Magnetic Field Penetration Insert

The MFPI Has Continued to Test Samples in The MFPF'S Absence.

4 Comparisons.

Data Analysis has improved since the Introduction of a Magnetic Shield

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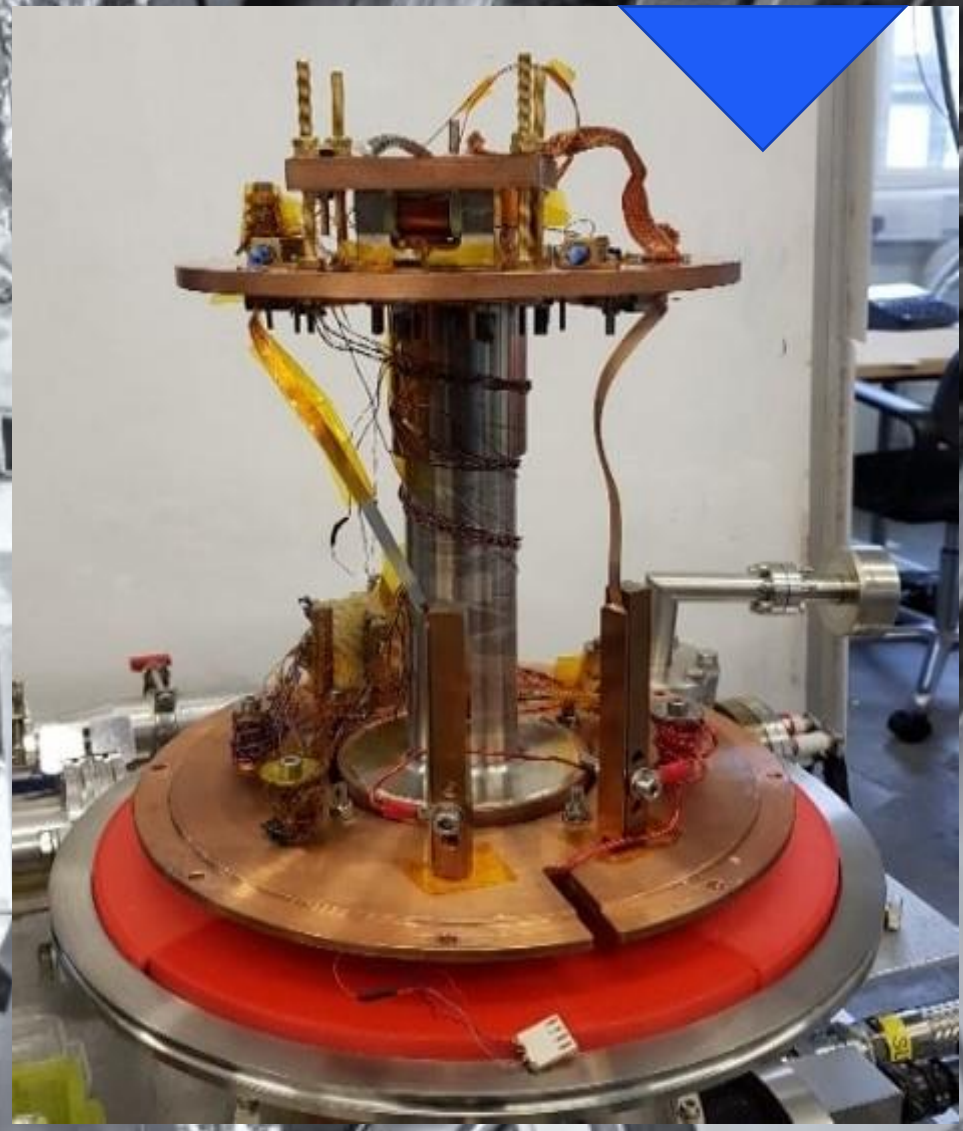
Magnetic Field Penetration Facility
Aims of Upgrade

- Upgrades are being made to optimise the testing efficiency of samples, throughout our Thin films testing processes. To solve the following issues:
    - Needs to cut samples after RF test.
        - Solution: Larger sample holder.
    - To limit damage to the sample from the magnet poles
        - Pressure to sample is applied at the edges rather than the centre.
    - Need to measure Split cavity.
        - Solution: Suitable sample holder and magnet poles.
    - Reduce magnetic field leakage around the sample.
        - Solution: Magnetic shields located around Hall probe 2.



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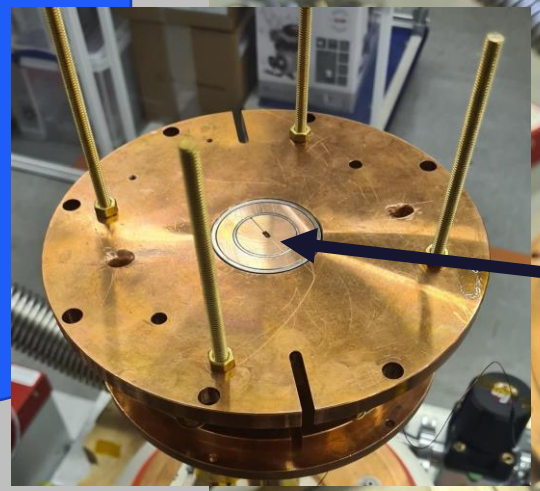
Magnetic Field Penetration Facility Status

- New sample plate added to allow larger sample testing, and accommodate Hall Probe Shielding.
- The Facility will improve our ability to test samples from multiple parameters with limited disturbance.
  - To accommodate samples from EXP900 of ∅100 mm.
  - To measure Split cavity samples.

- New Hall probes (Paragraf sensors) with higher resolution have been installed. (Previous resolution = 0.4 – 0.7 mT, aiming for 1 order of magnitude lower).

- Hall probe Shielding has been installed:
  - d = 30 mm, w = 1 mm and L = 50 mm
  - d = 50 mm, w = 2 mm and L = 50 mm



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Magnetic Field Penetration Insert

- This our original facility which has been modified to:
  - Lower sample temperature from 8 to 6 K.
  - Adding magnetic shield (same as MFPF).
  - New magnet power supply procured.

- Insert has been in operation, while the MFPF is under redesign and upgrade.

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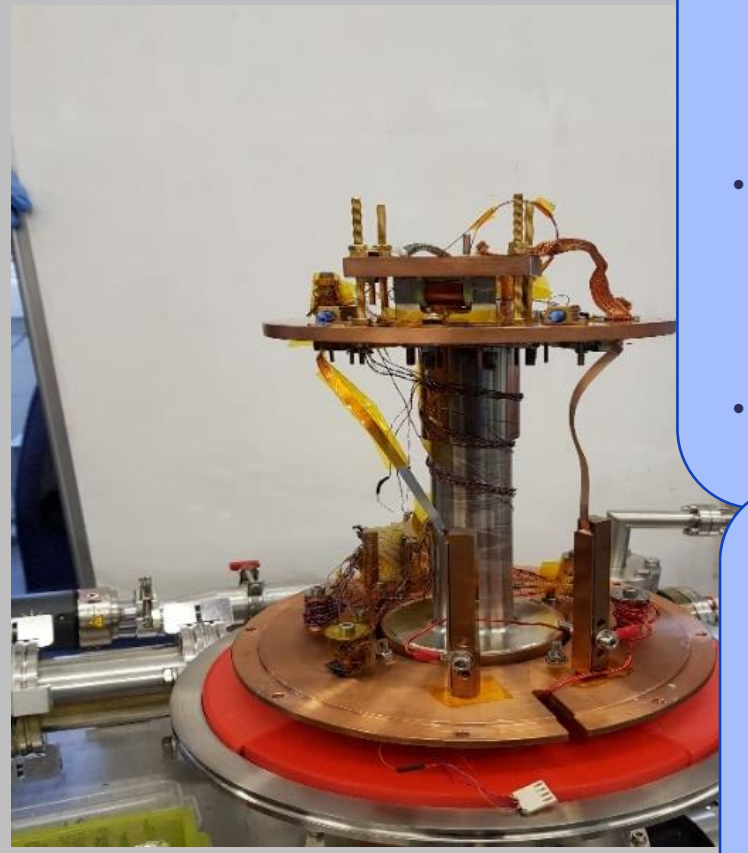
Two Penetration Facilities At Daresbury :

Magnetic Field Penetration Facility (EXP 700).



- Temperature range: T = 2.6 – 20 K, under vacuum heat load.
- Sample Range = ≤ 50 x 50 mm. (under current format).
- Magnetic Flield: = 600 mT.

Advantages:

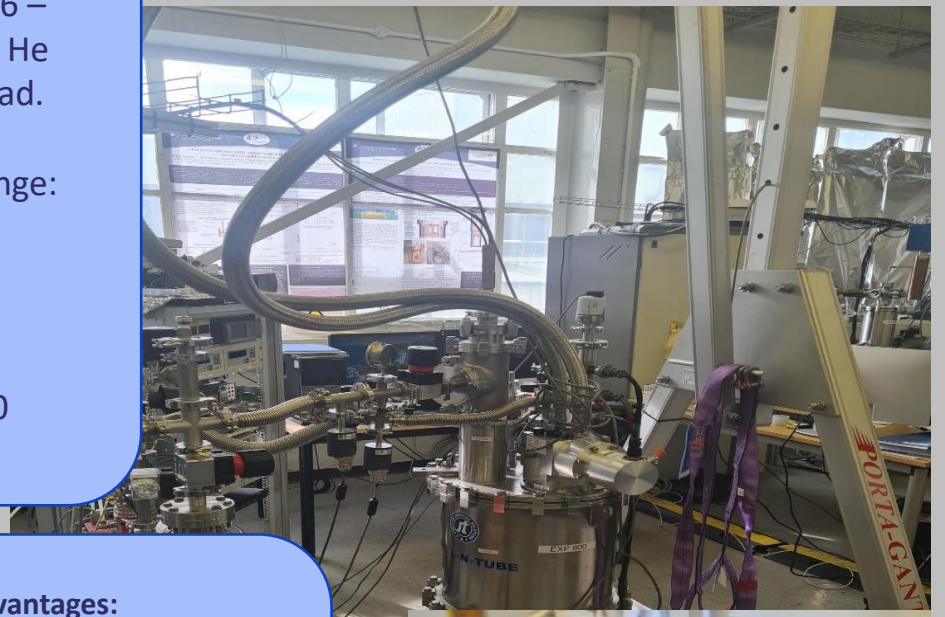
1. *Lower range of sample temperature.*
2. *Larger Sample size.*

Disadvantages:

1. *Longer experiment duration (1 sample in 2 days).*
2. *More complicated sample change-over method.*

Magnetic Field Penetration Insert (EXP 800).

- Temperature Range: T = 6 – 20 K under He gas heat load.
- Sample Range: = ≤ 50 x 50 mm.
- Magnetic Field: = 600 mT.



Advantages:

1. *Quicker experiment duration (1 day turn-around).*
2. *Easy sample change method.*

Disadvantages:

1. *Smaller sample size range.*
2. *Higher sample temperature.*

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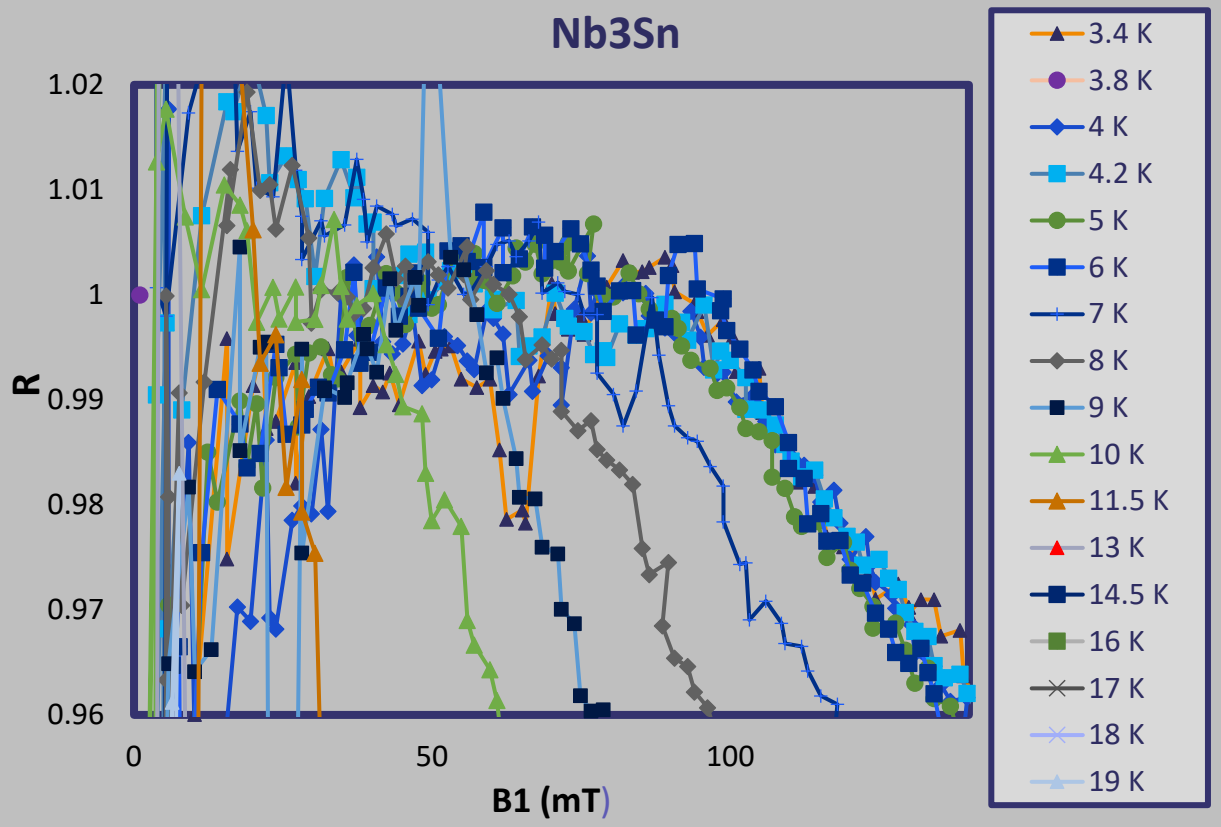
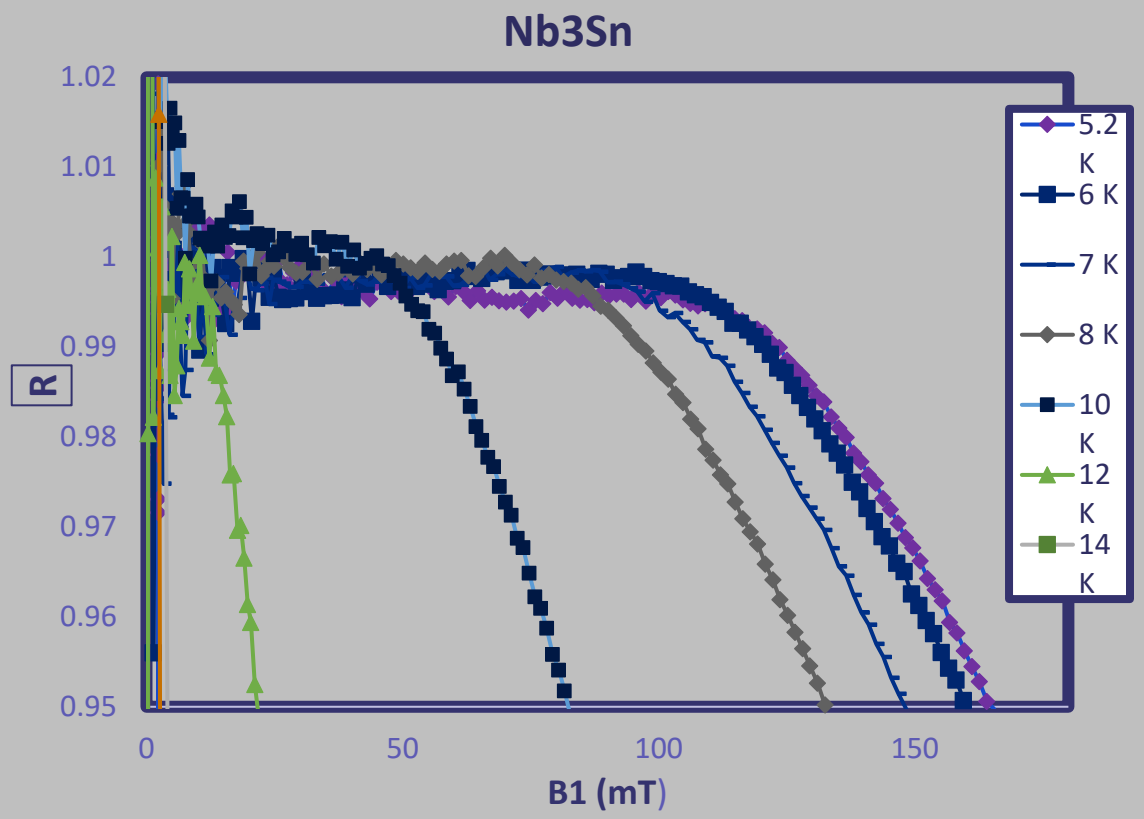
Comparisons.

Data Analysis has improved since the Introduction of a Magnetic Shield

$$R = 1 - B_2/(B_1K_1)$$





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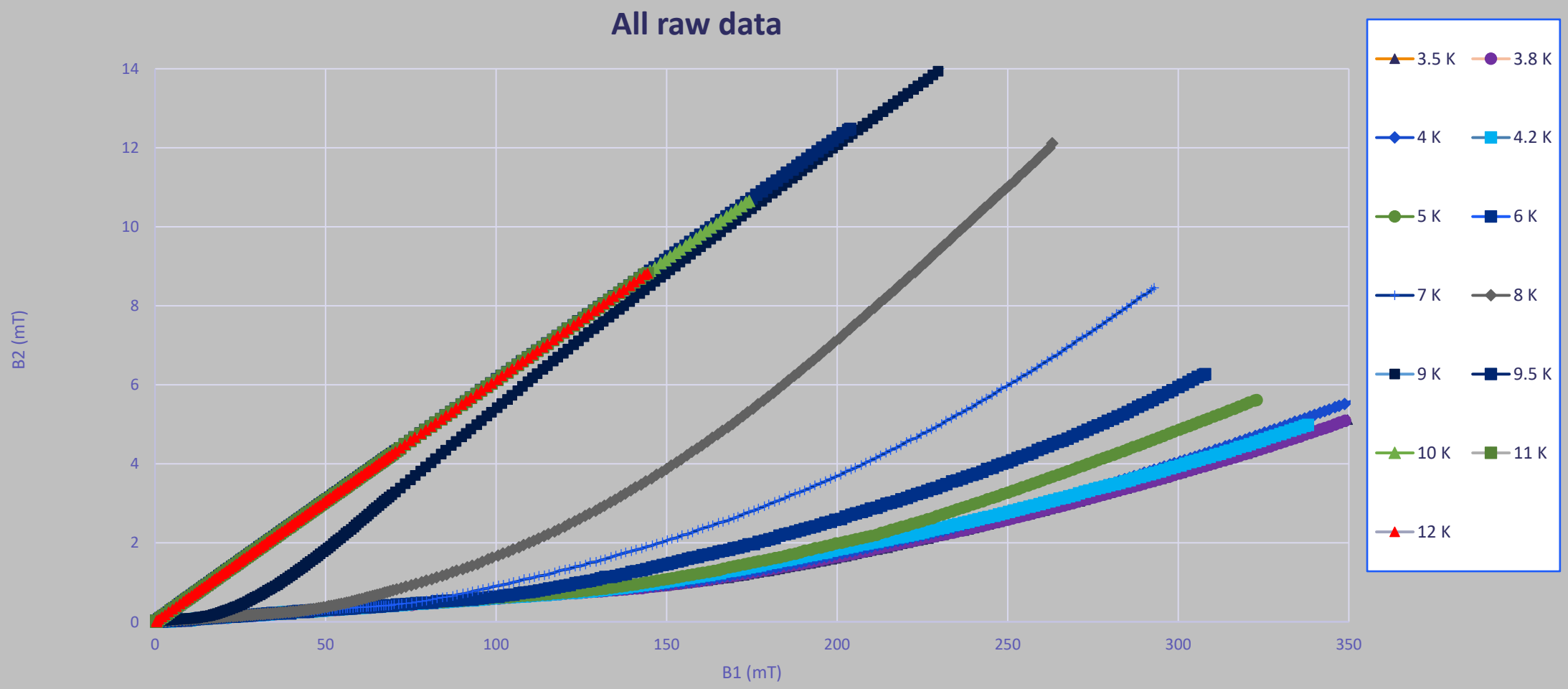
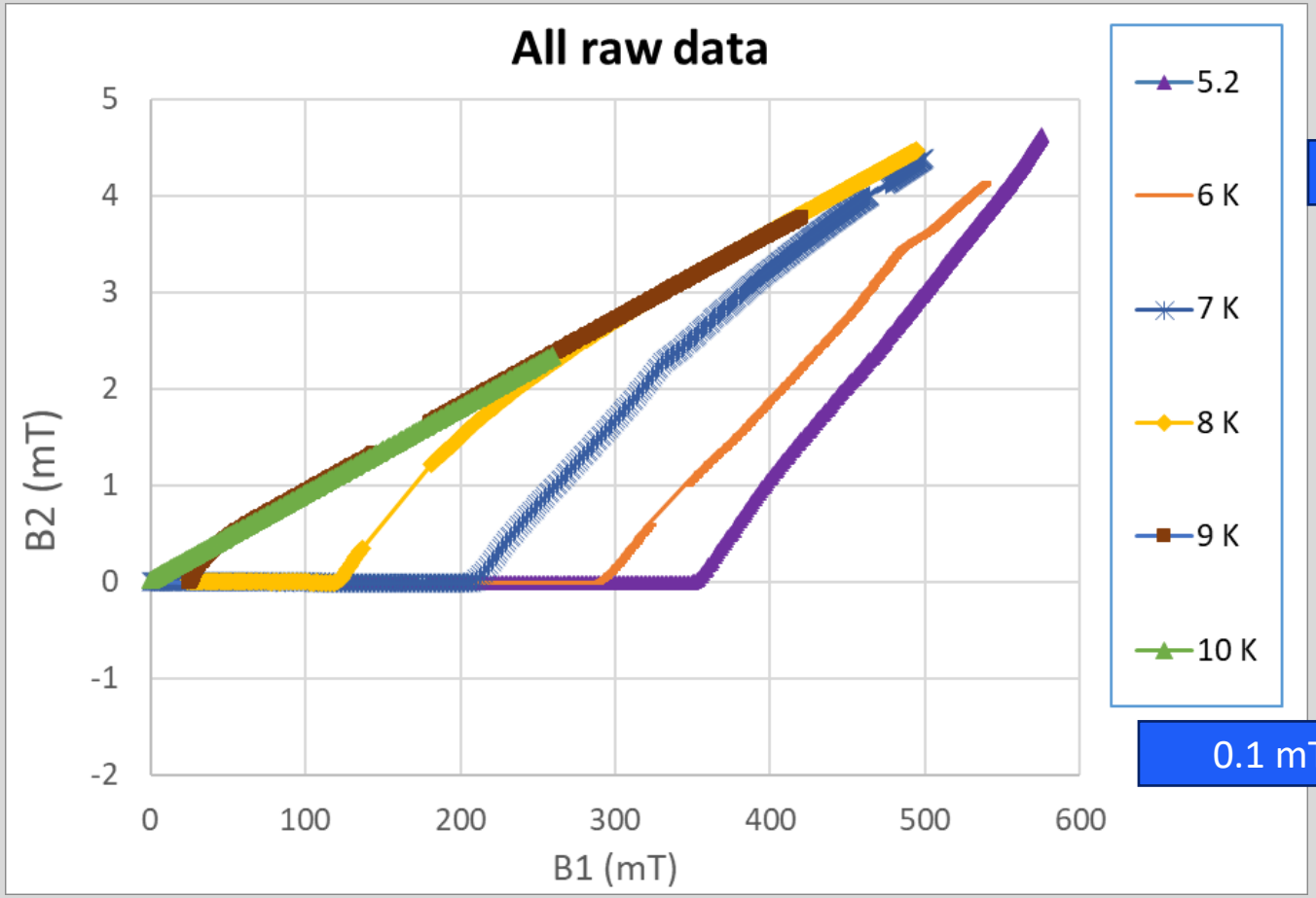
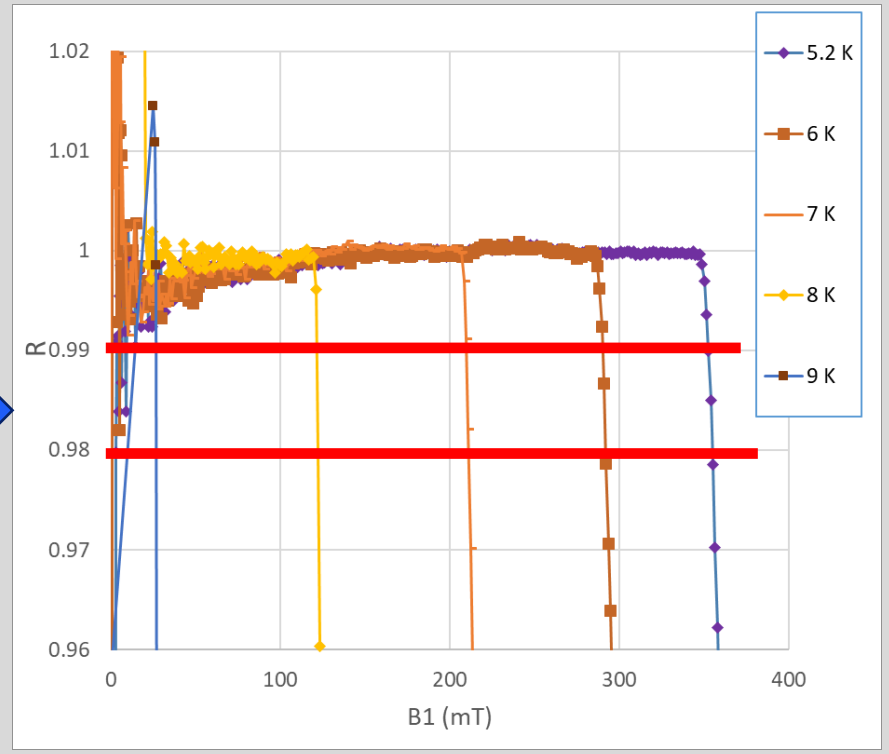
Nb Cu


All raw data
B2 (mT)
B1 (mT)
0
2
4
6
8
10
12
14
0
50
100
150
200
250
300
350
3.5 K
3.8 K
4 K
4.2 K
5 K
6 K
7 K
8 K
9 K
9.5 K
10 K
11 K
12 K

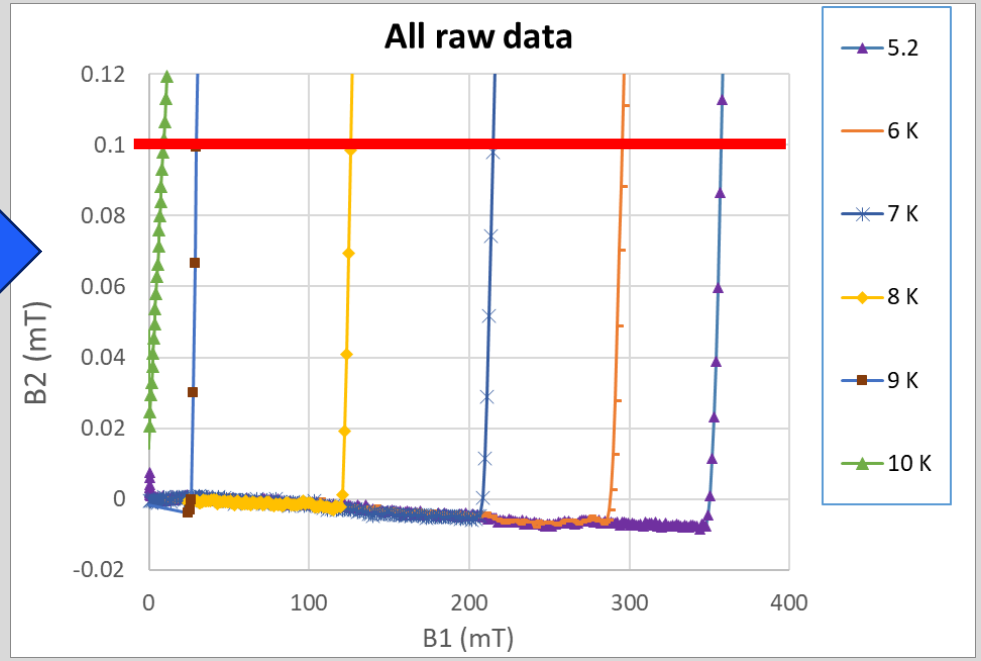
Bulk Nb



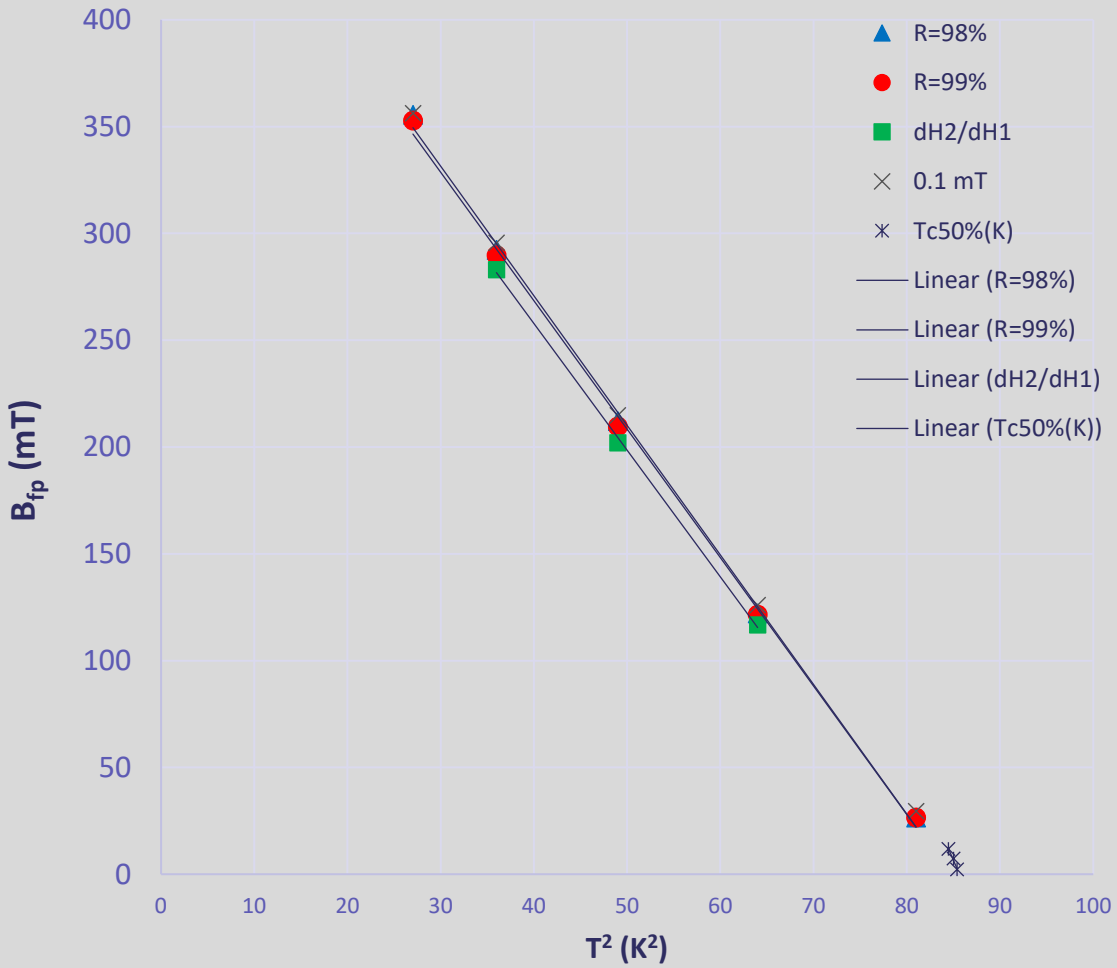
R method



0.1 mT method



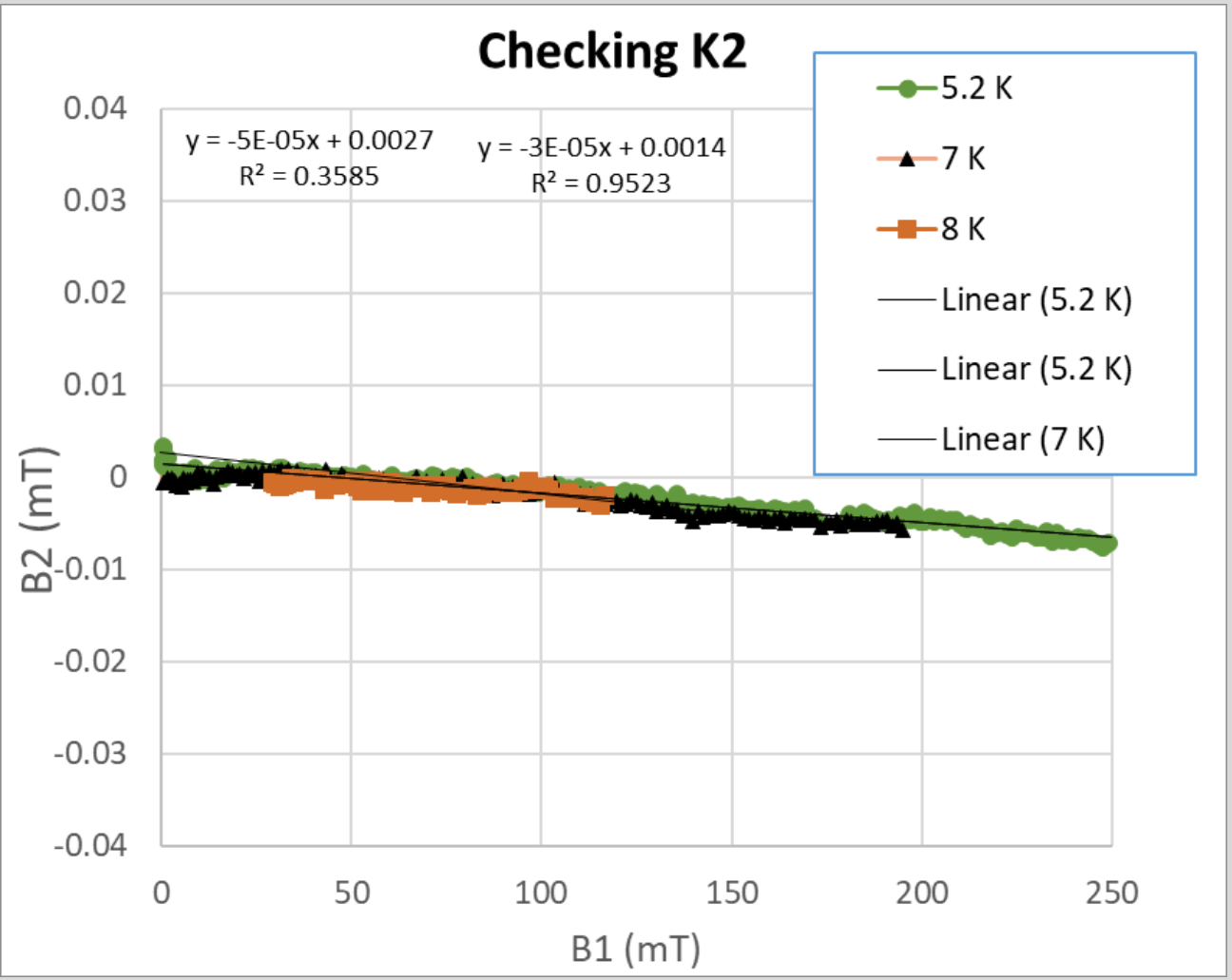
Bulk Nb results

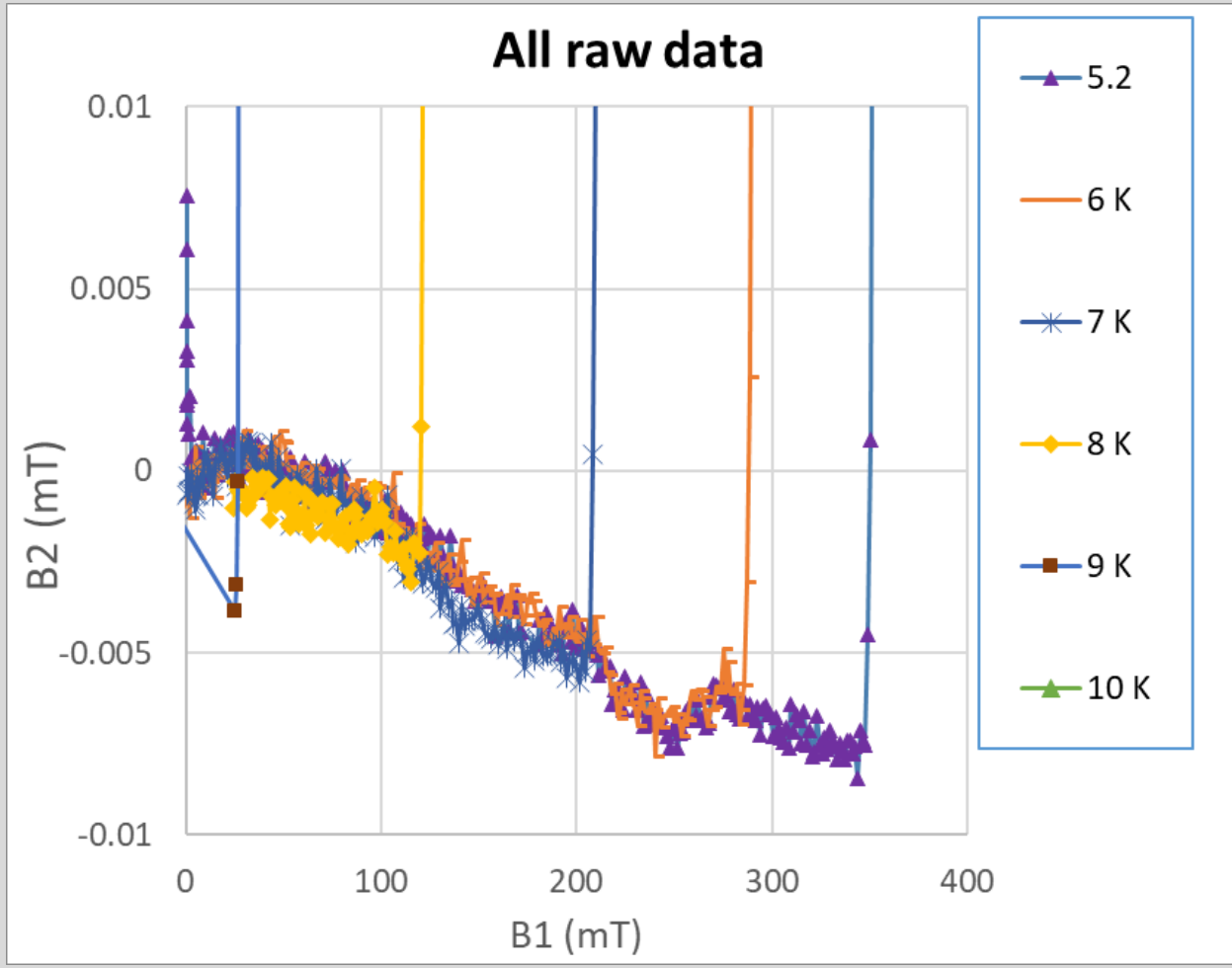


Extrapolation from MFP runs				
	98%	99%	dB2/dB1	0.1 mT
a	-6.07	-6.01	-6.13	-6.03
Bfp(0K)=	513.55	509.12	506.37	514.58
Tc(0mT) =	9.20	9.20	9.09	9.23
Bfp(4.2K)=	406.55	403.06	398.17	408.15

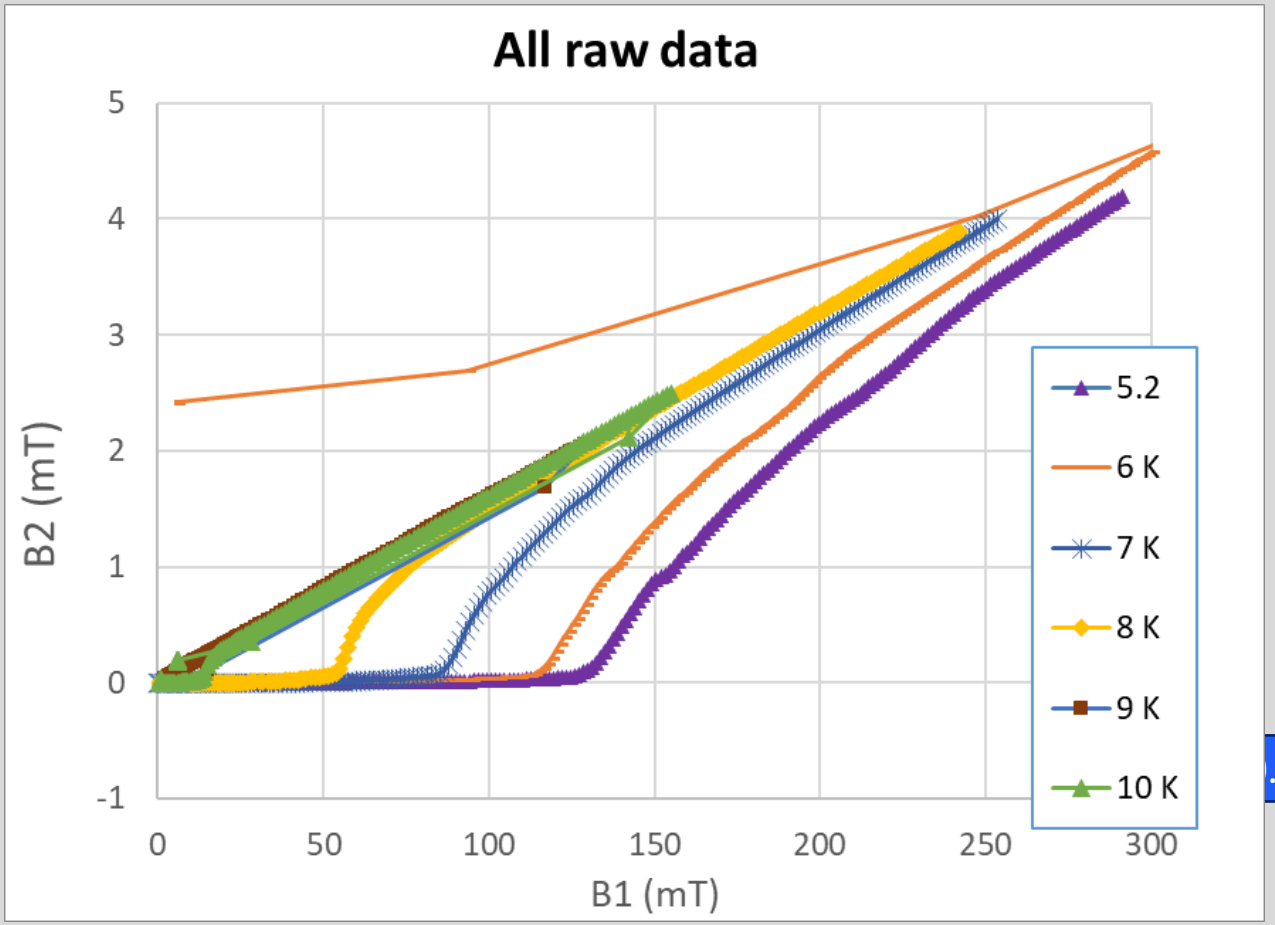
From T_c measurements		
Tc	"+ΔT"	"-ΔT"
9.254	0.032	0.032

Negative slope on Bulk Nb

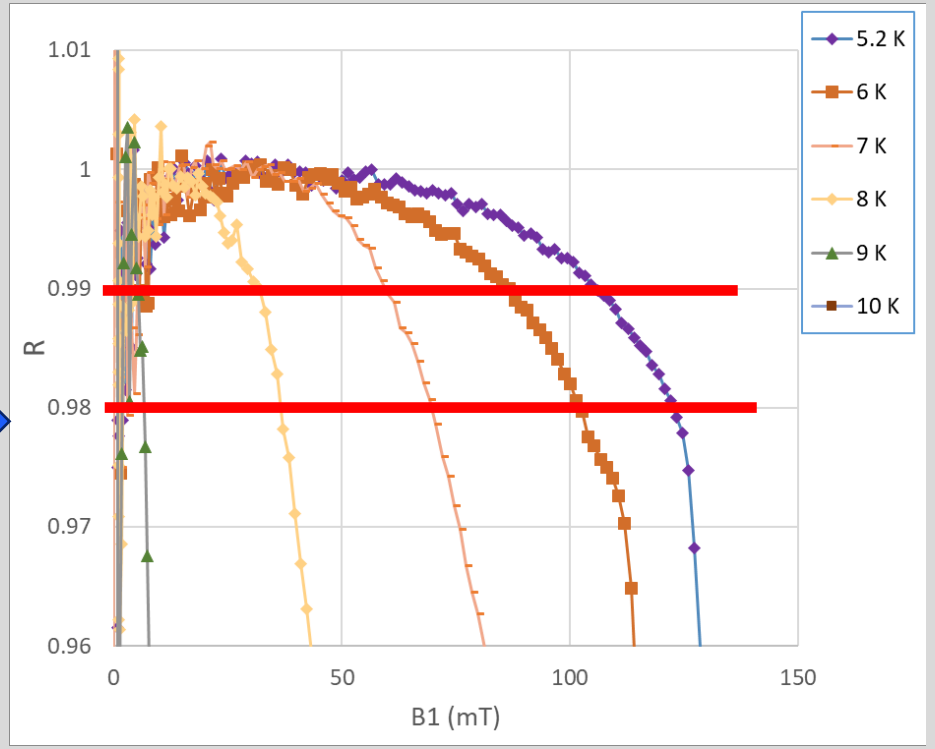




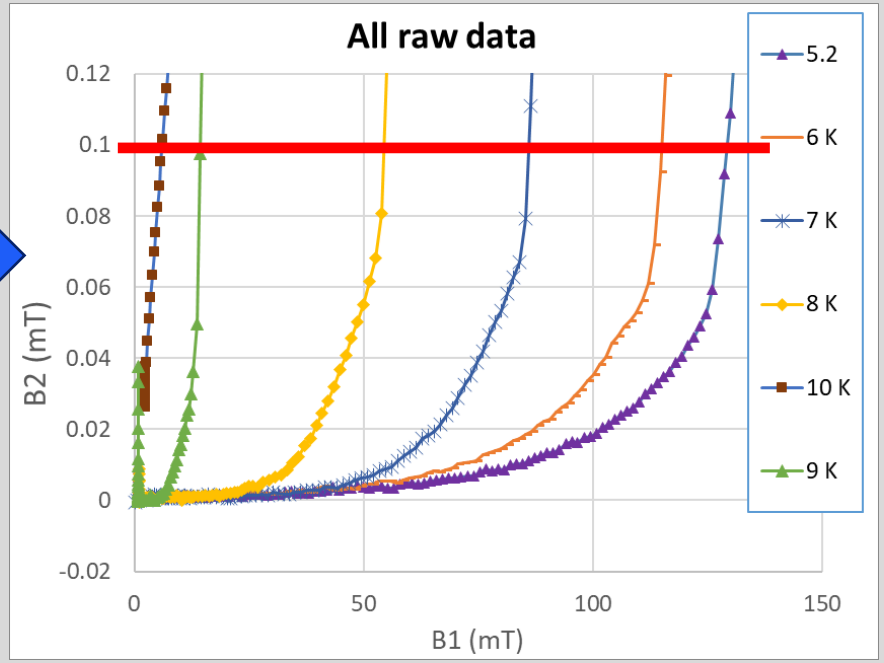
Thin film: Nb L19



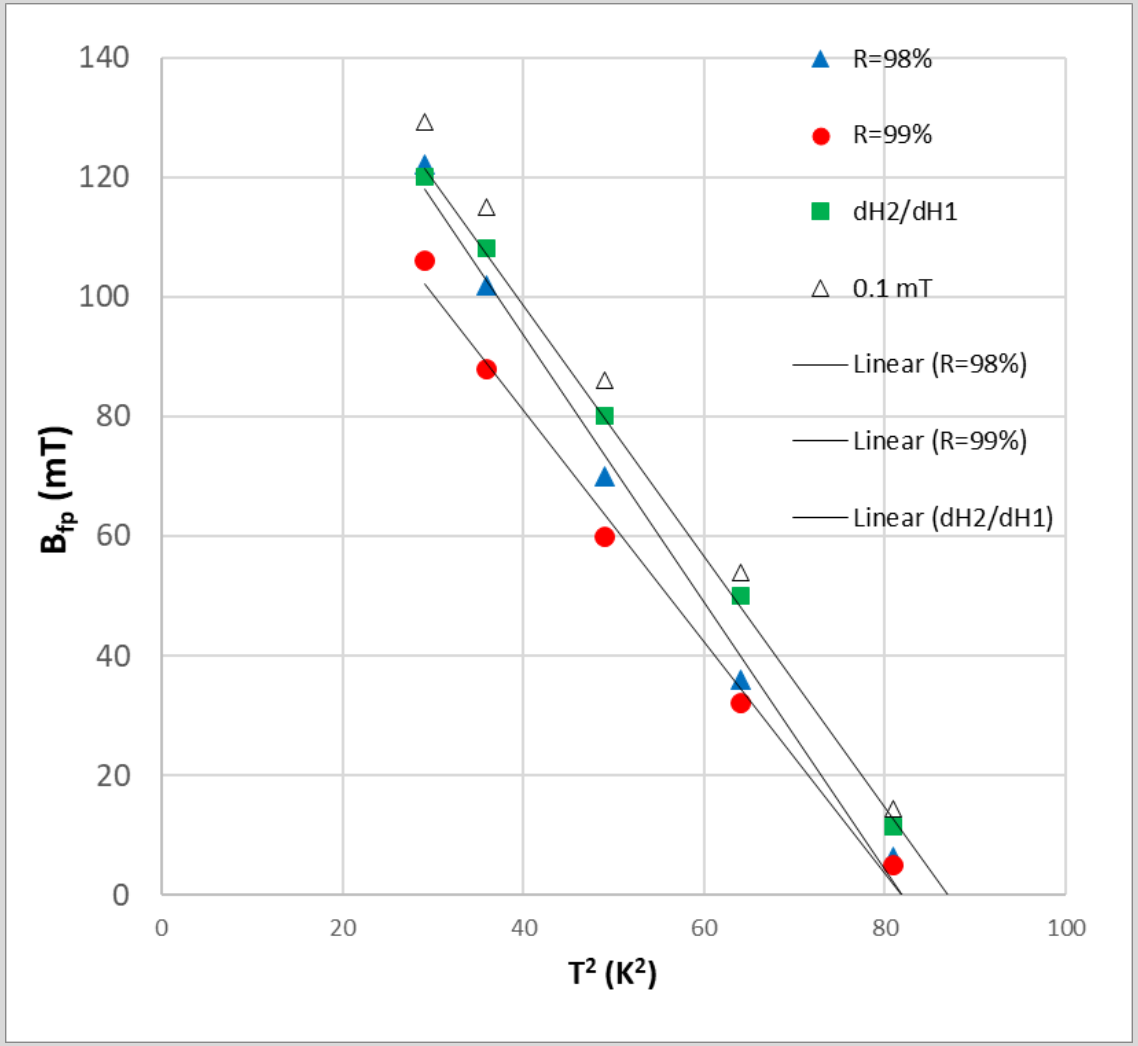
R method



.1 mT method

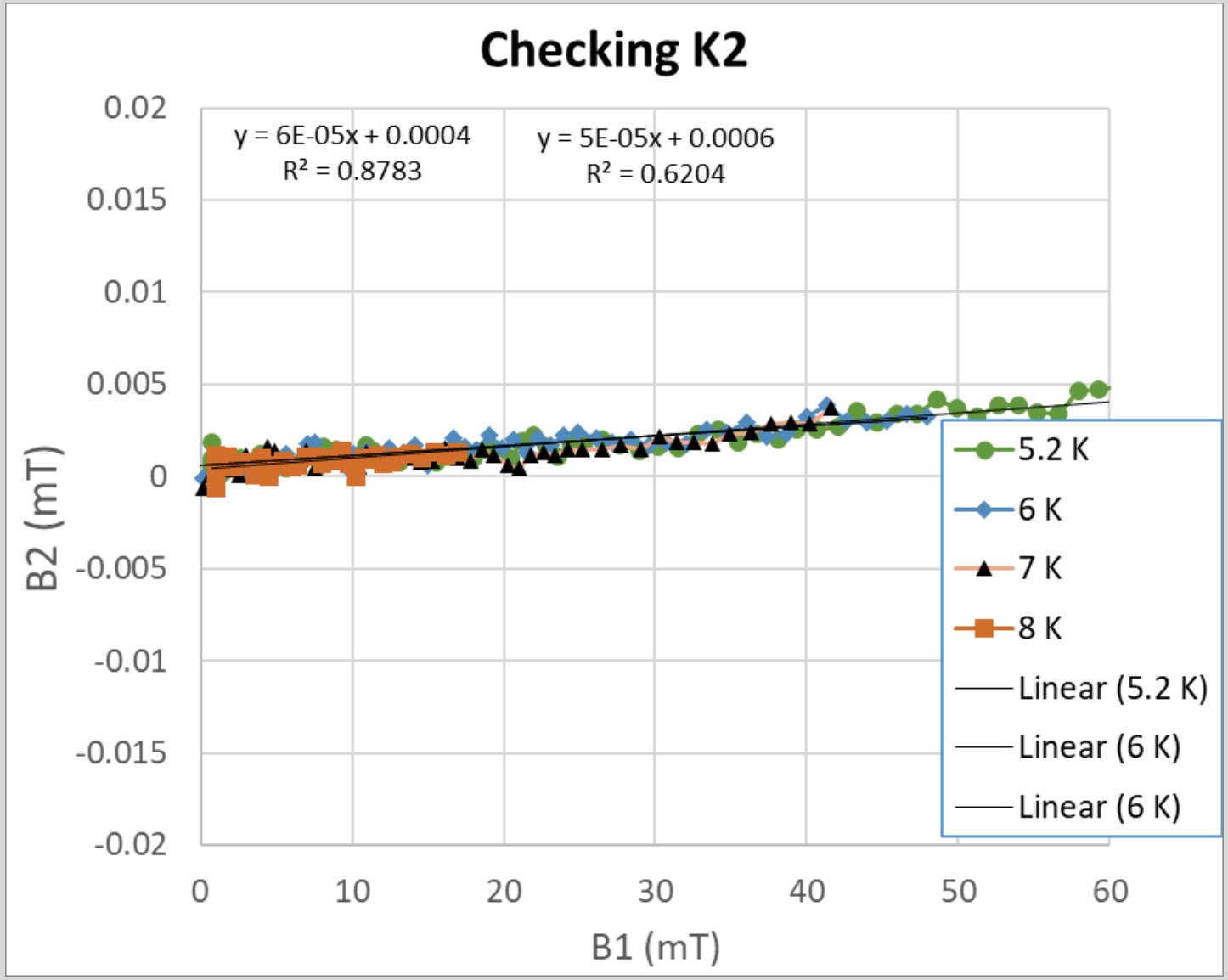


Nb L19 results

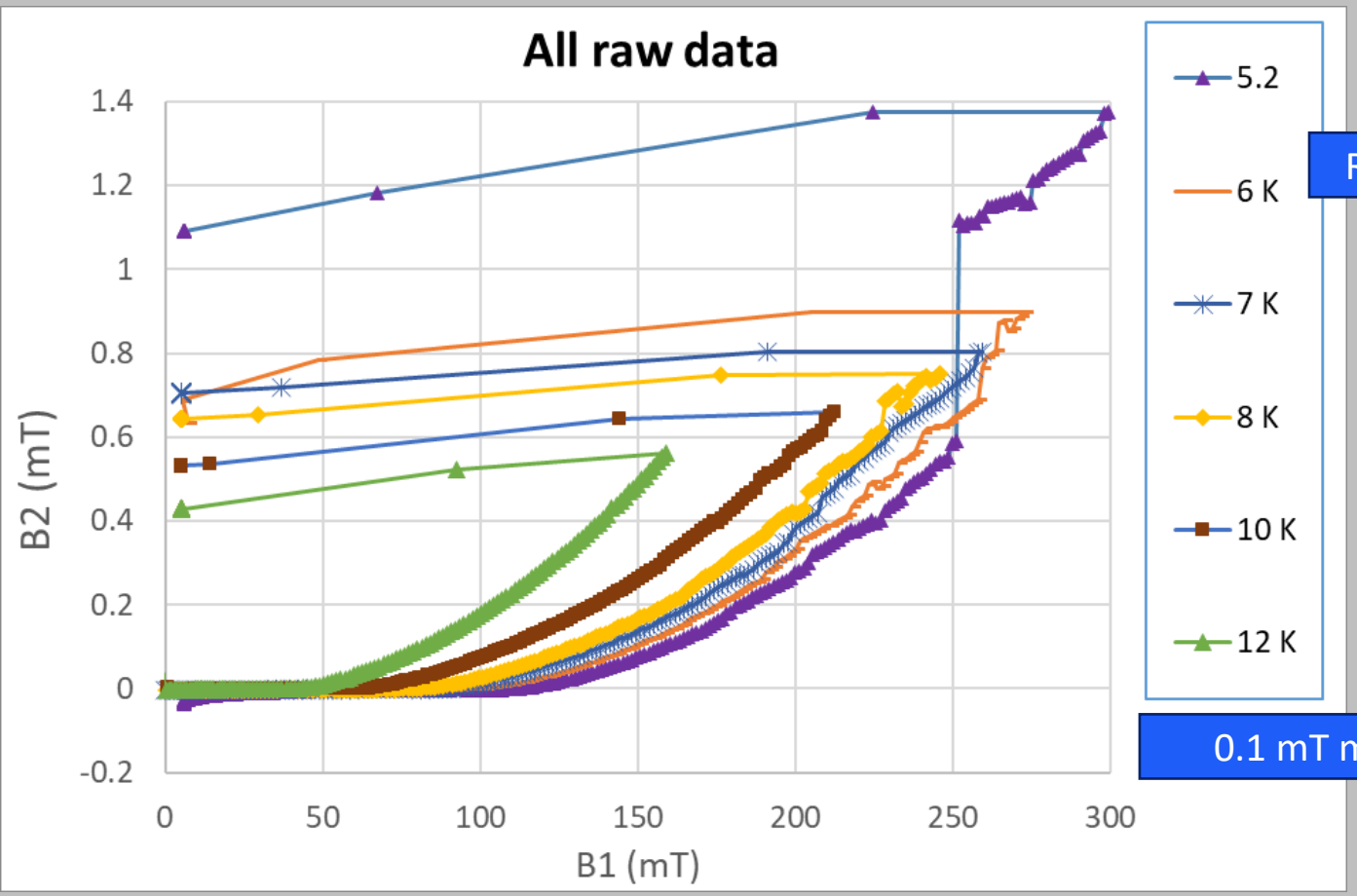


Summary for B_{fp} measurements				
		98%	99%	dB2/dB1	0.1 mT
	a	-2.23054	-1.93519	-2.09606	-2.20908
	Bfp(0K)=	182.9131	158.5247	182.5431	194.2412
	Tc(0mT) =	9.055613	9.050796	9.332127	9.377015
	Bfp(4.2K)=	143.5665	124.388	145.5685	155.273

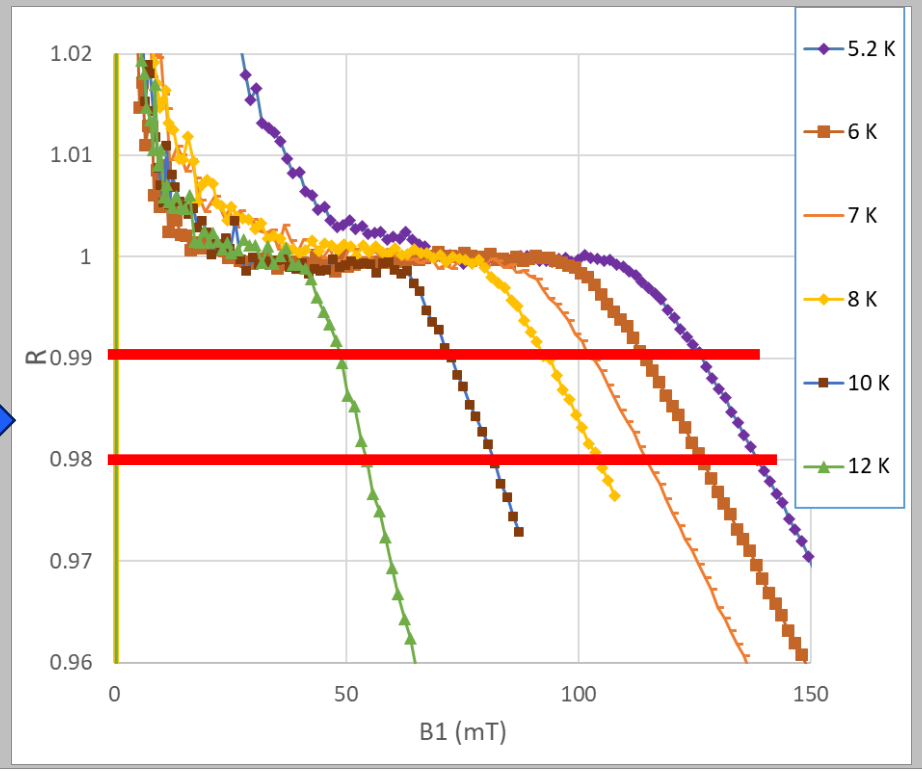
Weak positive slope on Nb L19



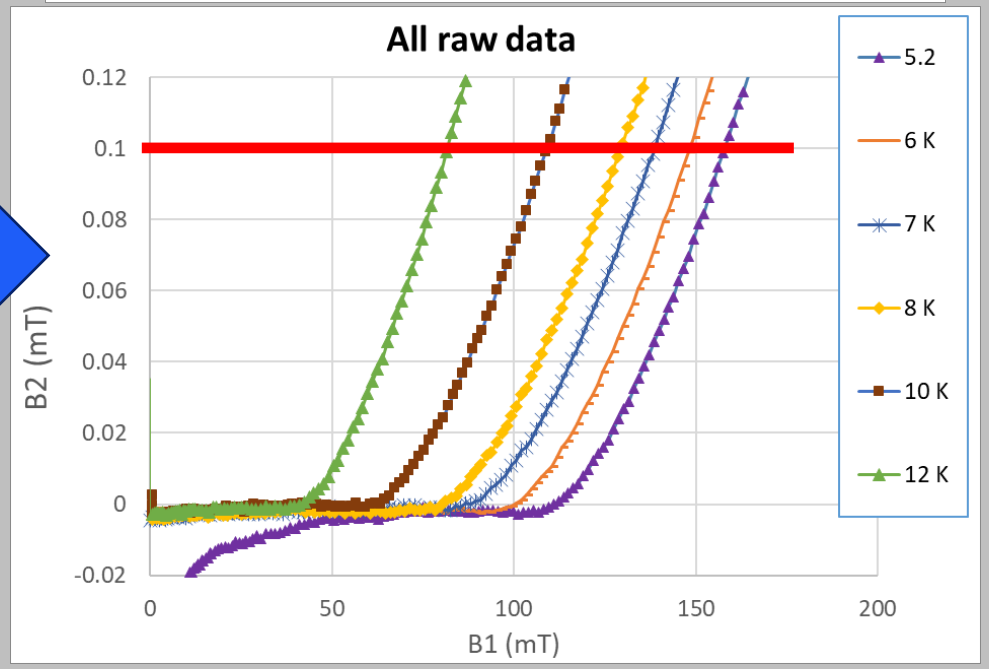
Nb_3Sn/Saphire



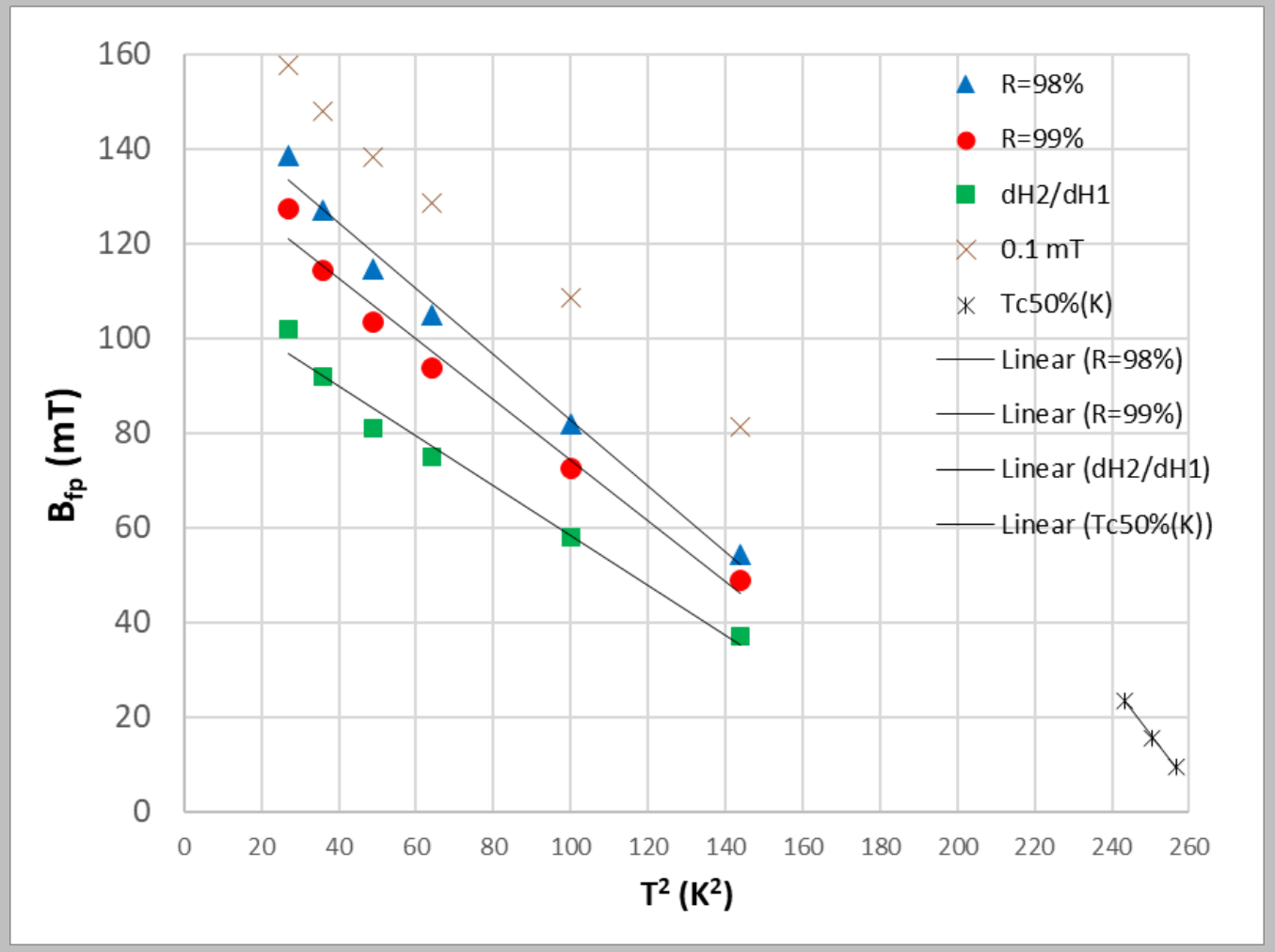
R method



0.1 mT method



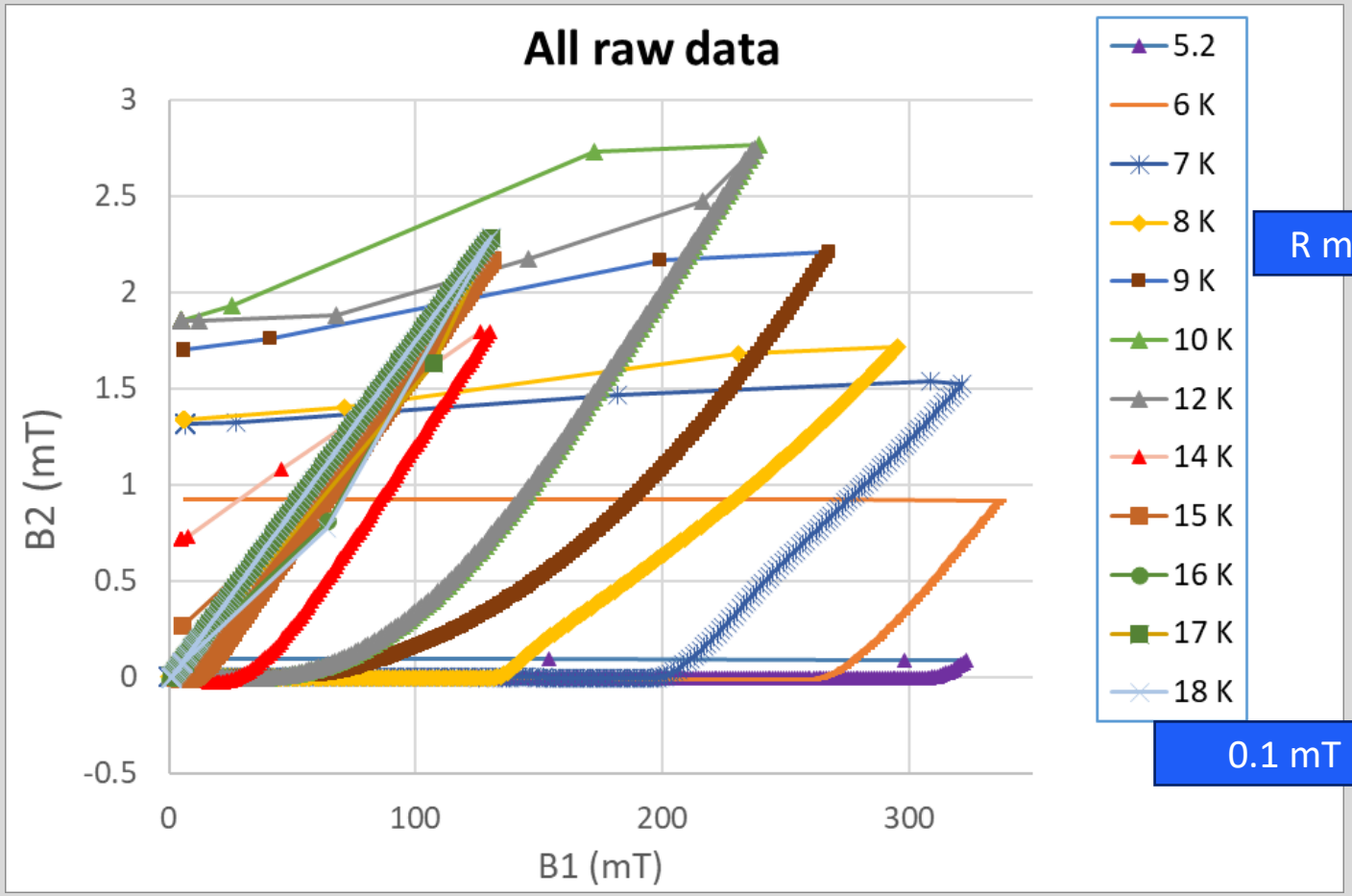
Nb_3Sn/Saphire results



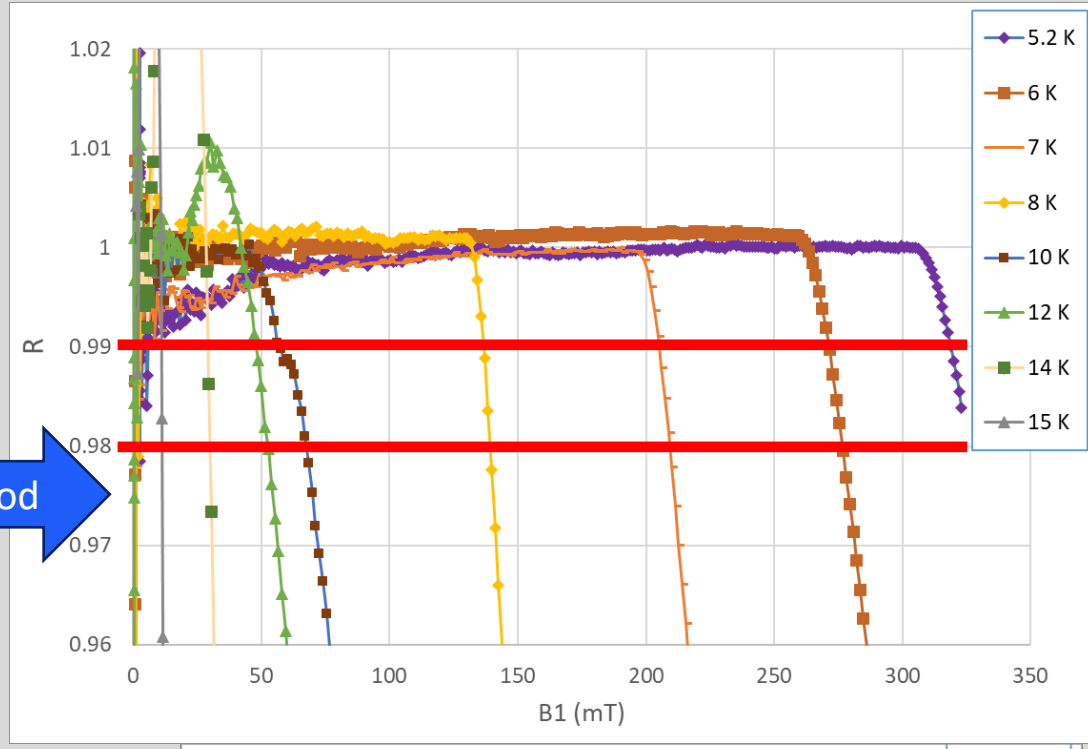
Summary for B_{fp} measurements				
	98%	99%	dB2/dB1	0.1 mT
a	-0.69	-0.64	-0.53	-0.63
Bfp(0K)=	152.05	138.24	111.01	171.10
Tc(0mT) =	14.82	14.70	14.52	16.50
Bfp(4.2K)=	139.84	126.96	101.72	160.01

Summary for T_c measurements		
Tc	"+ΔT"	"-ΔT"
16.289	0.252	0.280

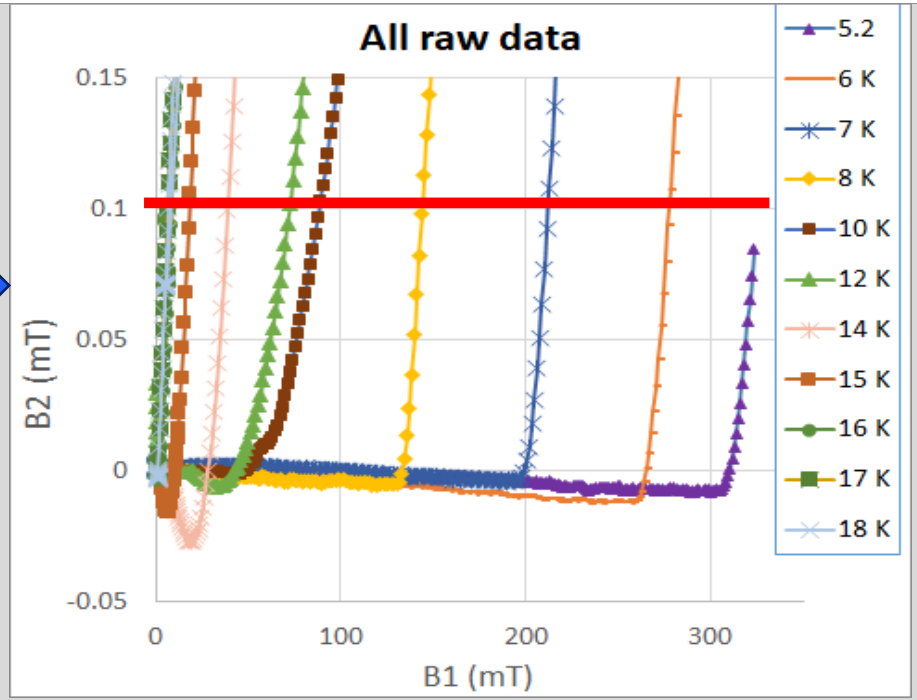
Nb_3Sn on Bulk Nb



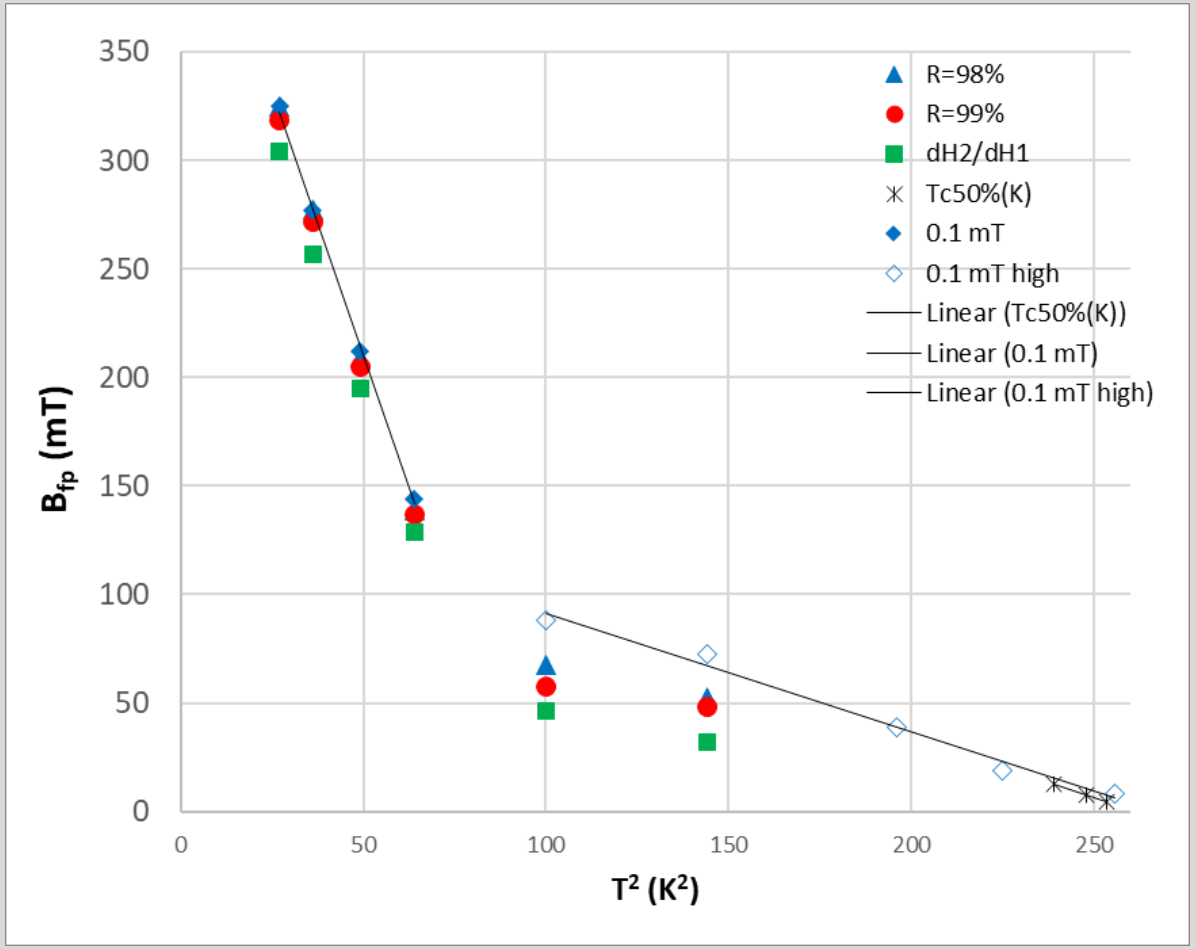
R method



0.1 mT method



Nb_3Sn on Bulk Nb - results



Summary for B_{fp} measurements

	98%	99%	dB2/dB1	0.1 mT low	0.1 mT high
a	-5.04	-4.92	-4.72	-5.14	-0.54
Bfp(0K)=	459.21	449.72	428.97	463.12	145.30
Tc(0mT) =	9.55	9.56	9.53	9.50	16.37
Bfp(4.2K)=	370.34	362.89	345.71	372.53	135.73

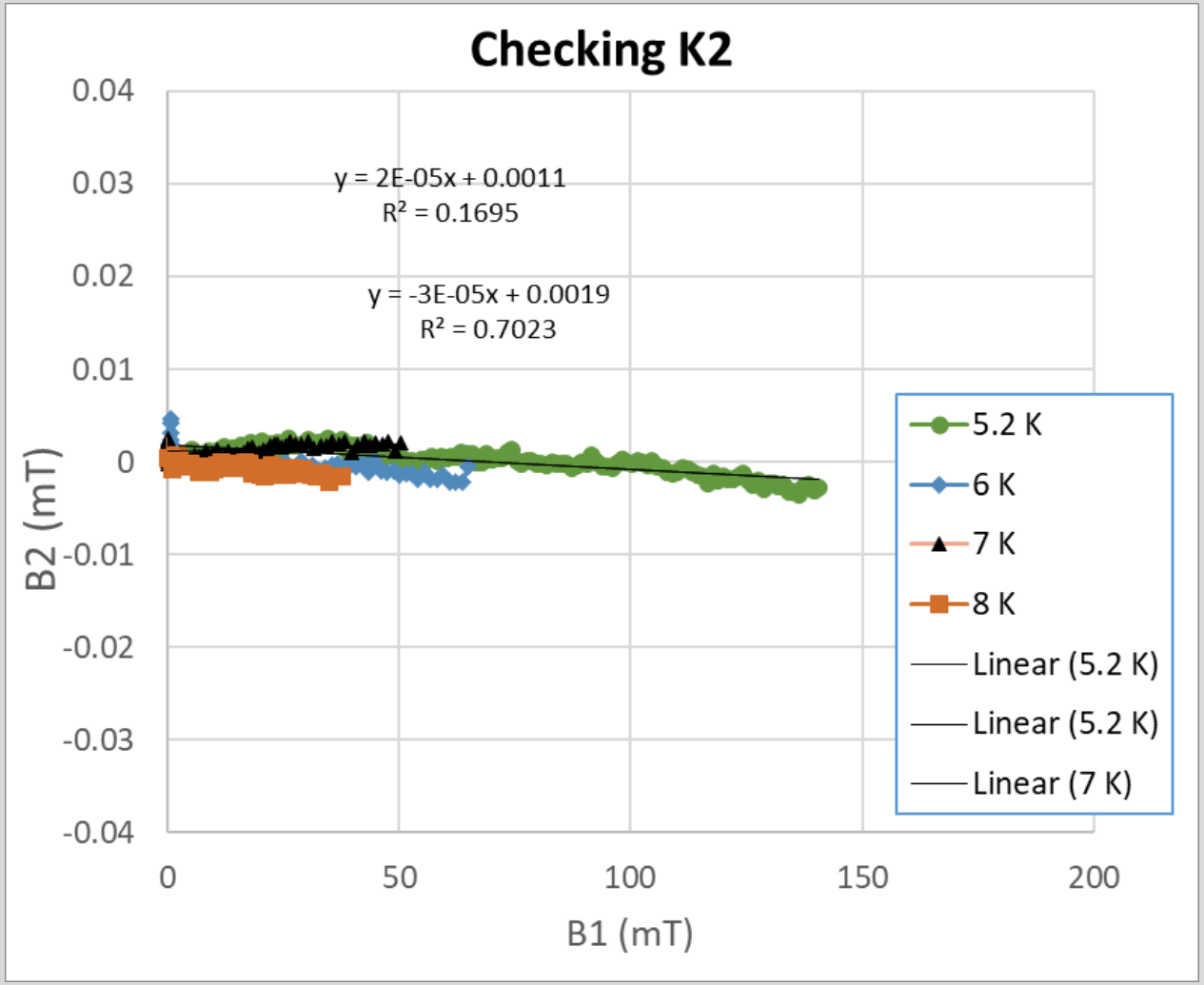
Bulk Nb

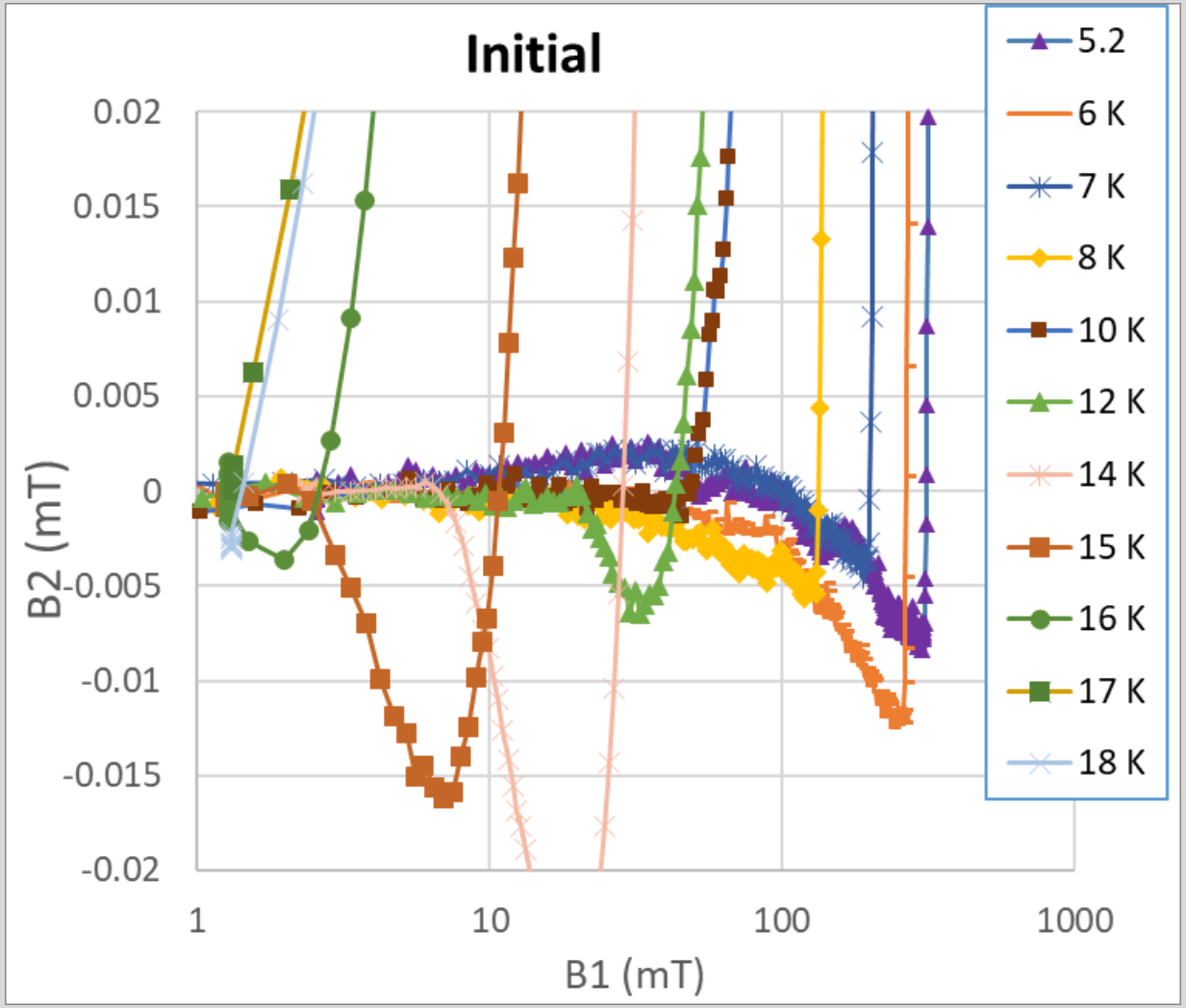
Nb_3Sn

Summary for T_c measurements

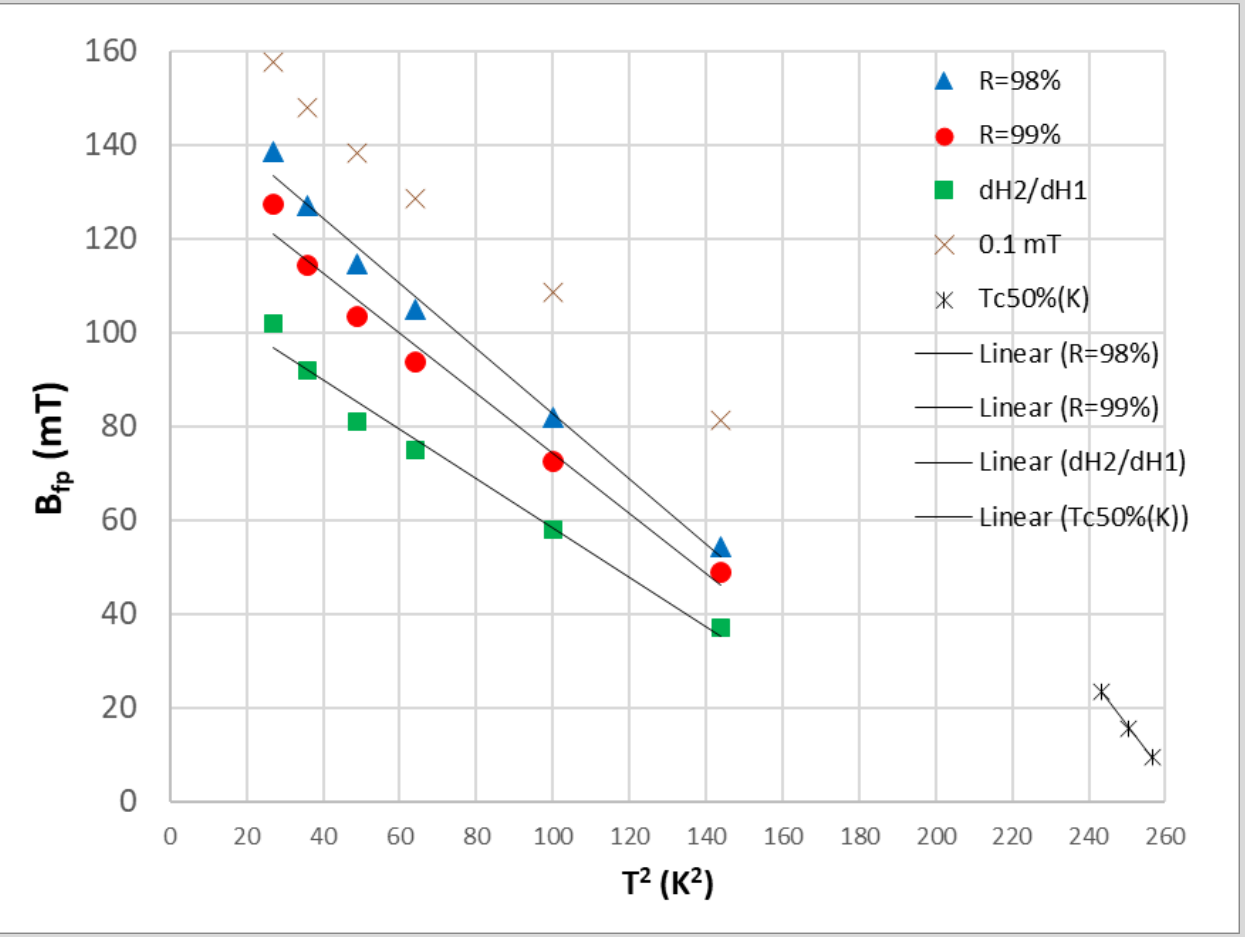
Tc	"+ΔT"	"-ΔT"
16.201	0.360	0.261

Negative slope on Nb_3Sn on Bulk Nb

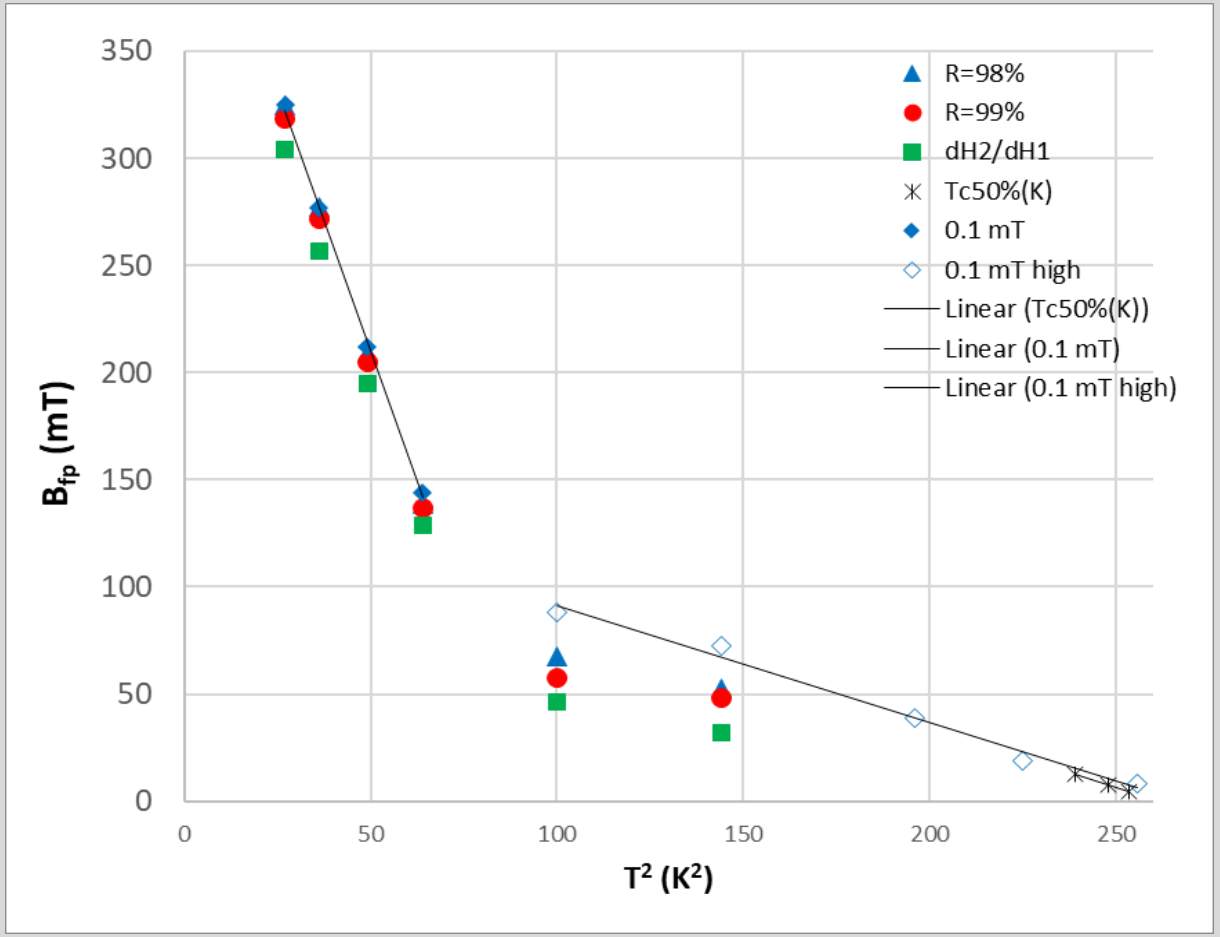




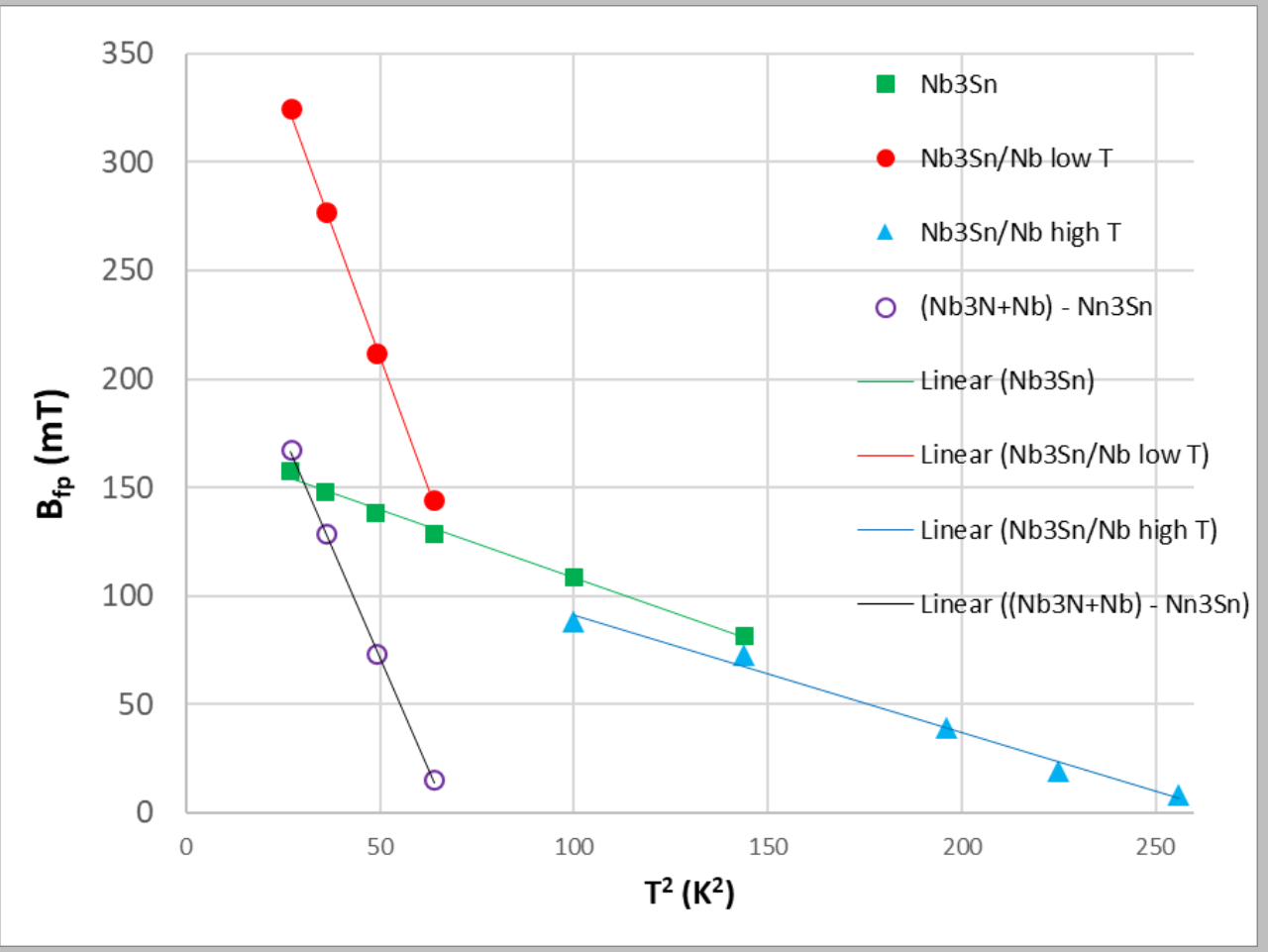
Nb_3Sn/Saphire

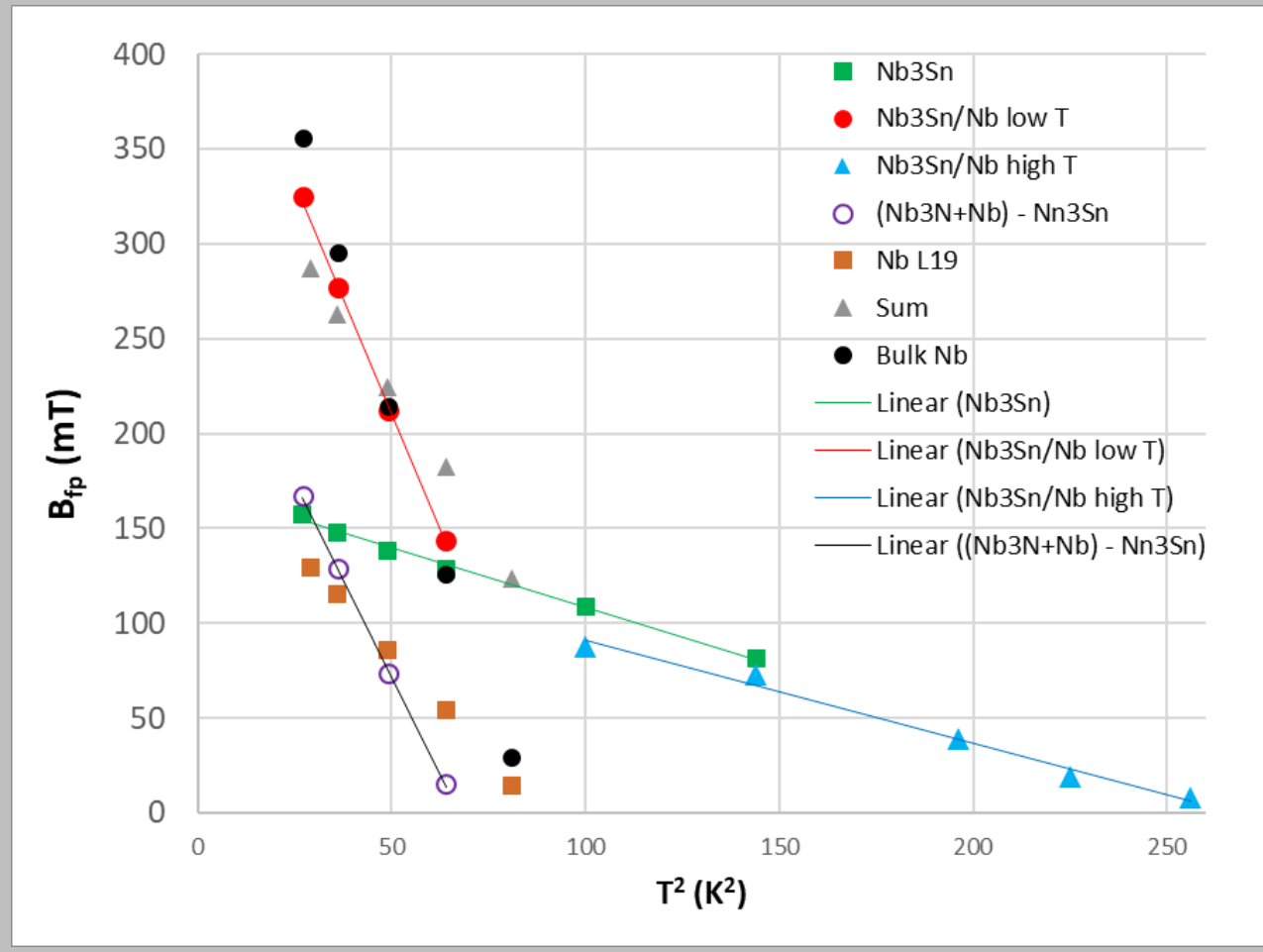


Nb_3Sb/Nb

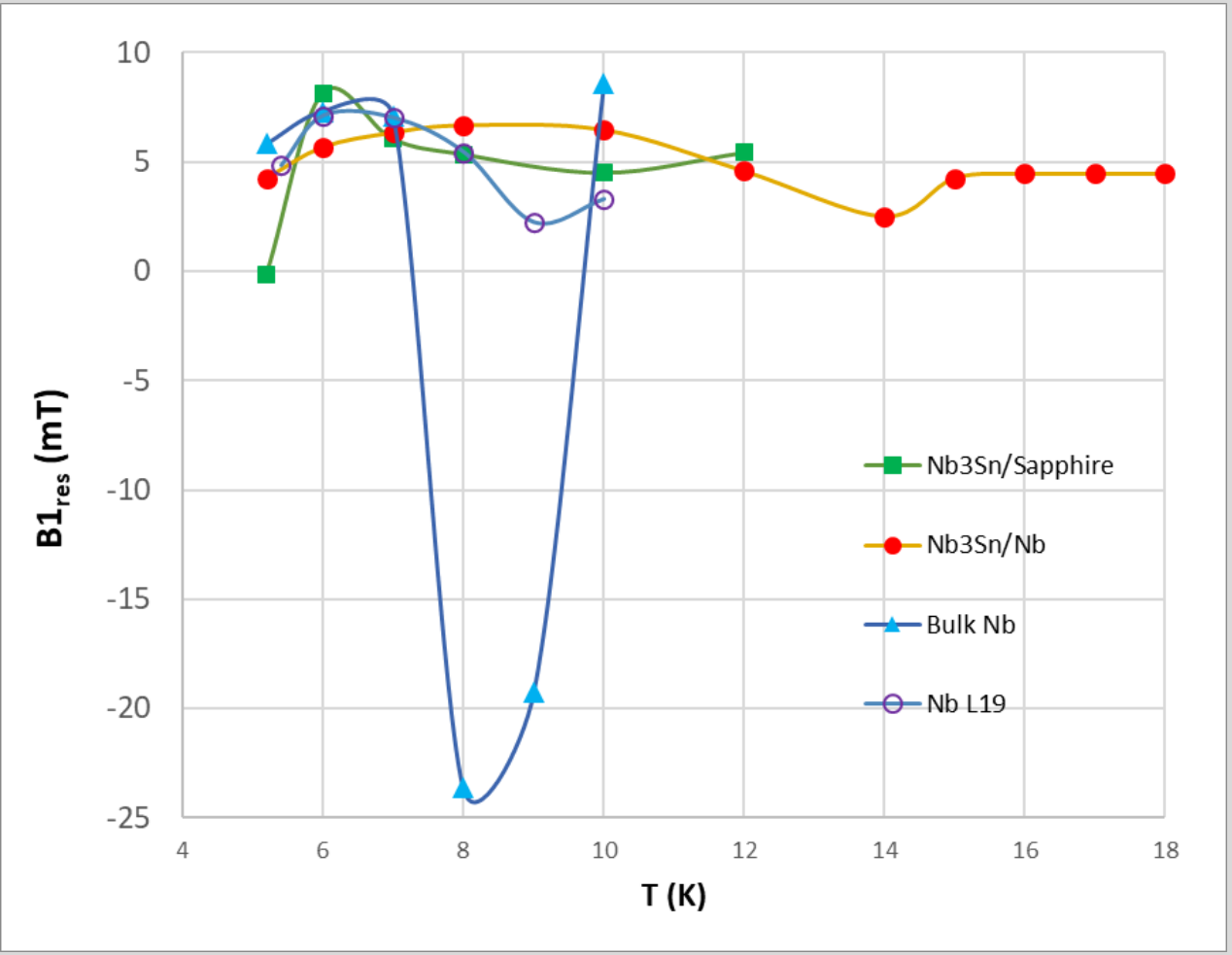


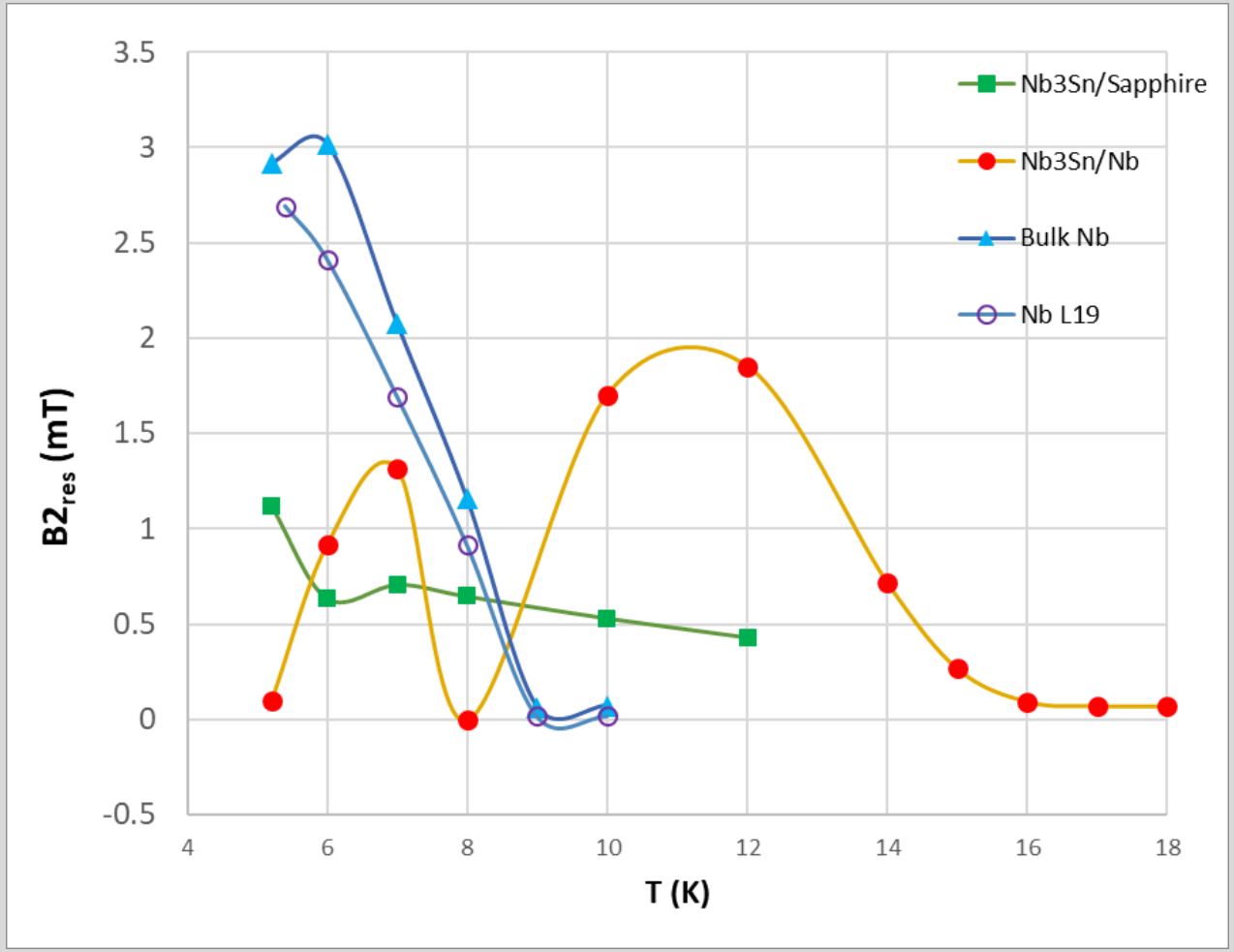
Summary for Nb_3Sn/Saphire and Nb_3Sb/Nb





Residual magnetisation





Conclusion

- Upgrades are being made to optimise the testing efficiency of samples, throughout our Thin films testing processes. To solve the following issues:

- The Facility will improve our ability to test samples from multiple parameters with limited disturbance.
  - To accommodate samples from EXP900 of ∅100 mm.
  - To measure Split cavity samples.

- The Magnetic Field Penetration Insert is in operation and is continuing to test sample's.

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Acknowledgements

STFC/CI: O. B. Malyshev, T. Sian, R. Valizadeh, D. Seal, J. Conlon, C. Benjamin, S. Pattalwar, A. Blackett-May, A. Vick, S. Wilde, S. Bibby-Trevor, R. McAllister

STFC/ISIS: G. Stenning

Lancaster University/CI: G. Burt, N. Leicester, H. Marks

University of Liverpool/CI: S. Simon, J. Bradley

INFN: C. Pira, E. Chyhyrynets, D. Ford, A. Salmaso

IJCLAB: D. Longuevergne, O. Hryhorenko

CEA: C. Antoine

IEE: E. Seiler, R. Ries

HZDR: S. Prucnal, S. Zhou

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Thank you

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Questions?