**Variable Temperature Transport Current Measurements on ReBCO Coated Conductors**

Francis, A.; Abraimov, D.; Viouchkov, Y.; Larbalestier, D.C. (NHMFL, FSU)

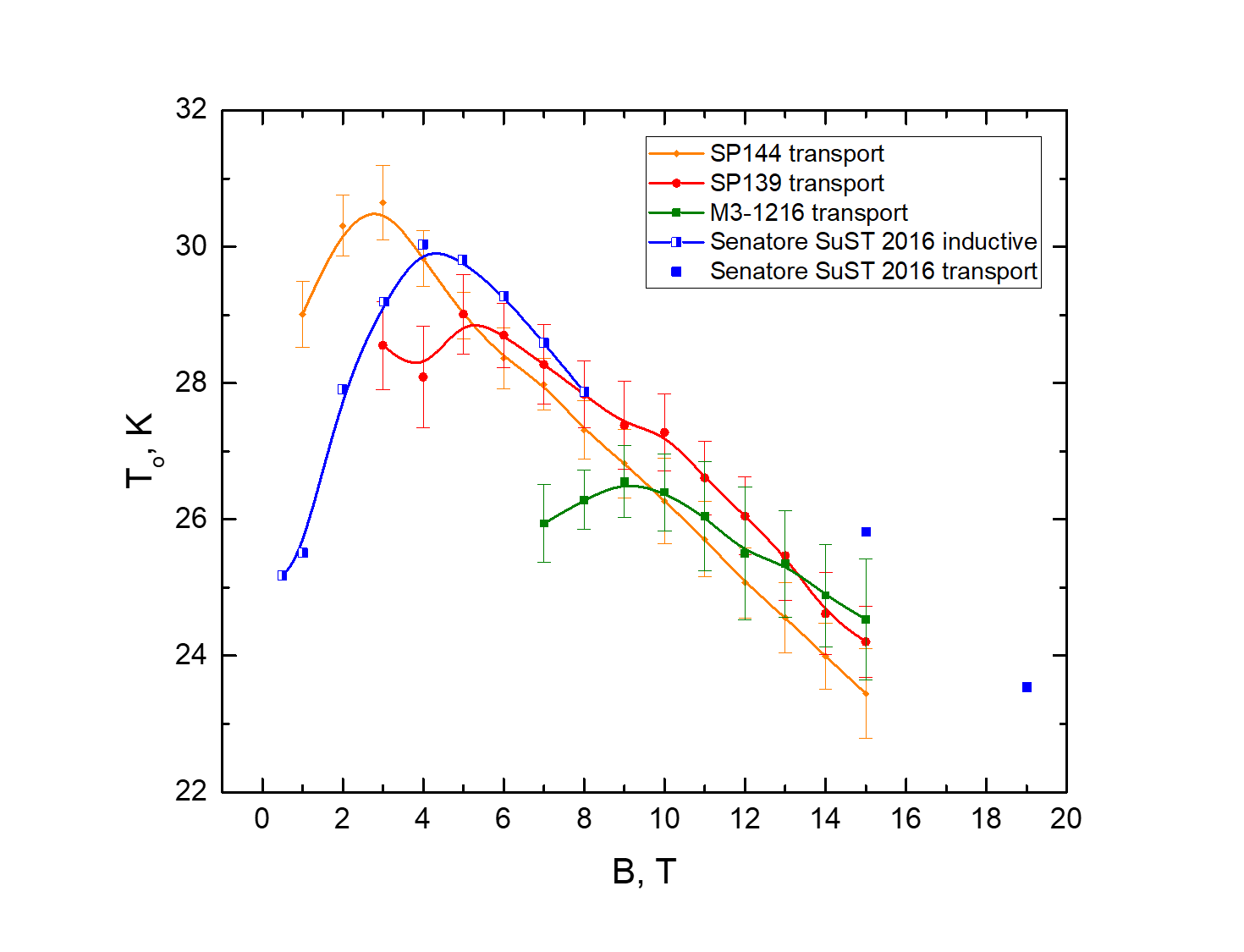
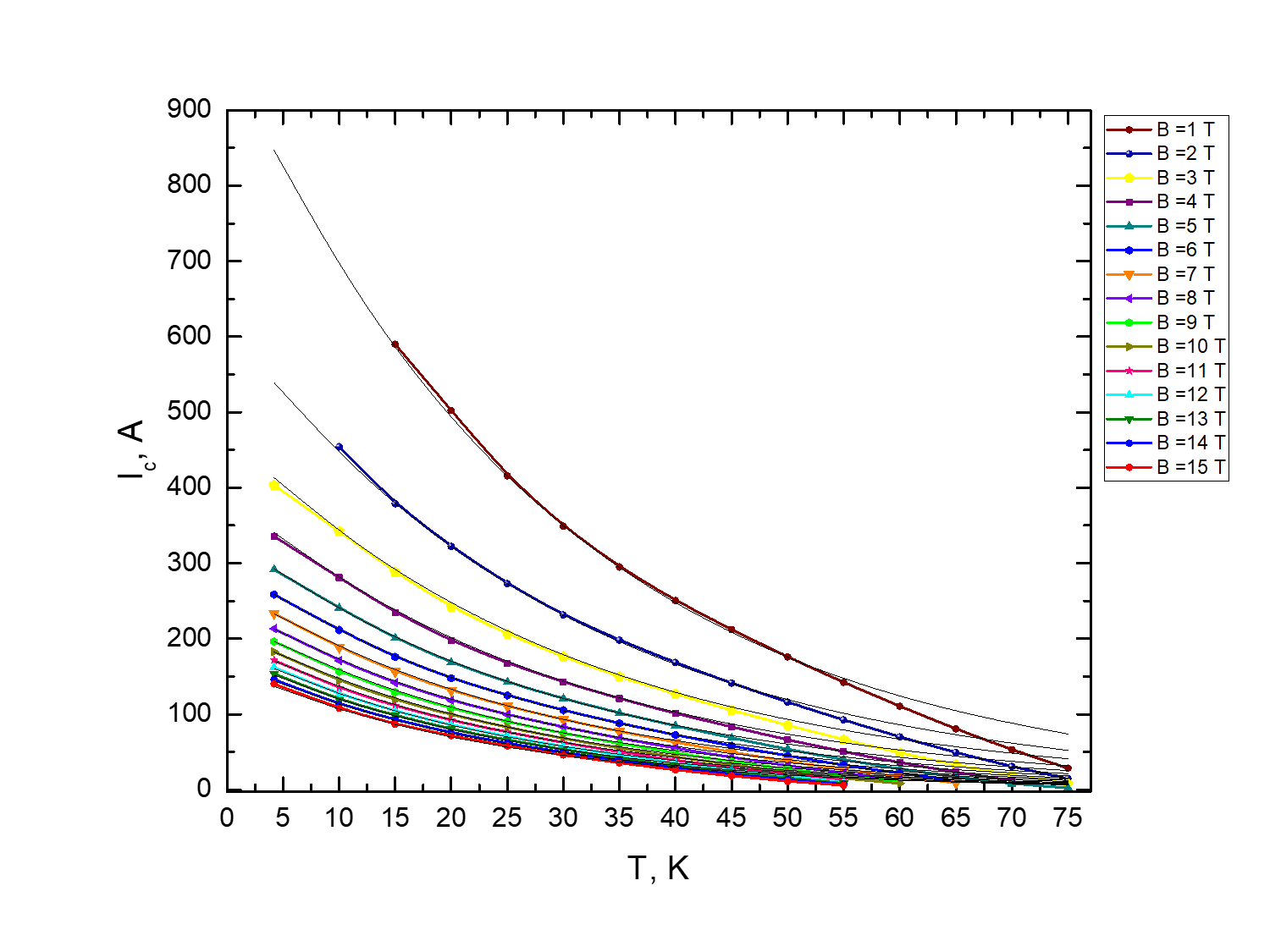
**Introduction**

Transport current measurements are essential in the design of magnet systems. A wide variety of ReBCO tapes are currently available from multiple suppliers. Critical current characterization of these at varying temperatures allows for tape selection and accurate modeling of quench behavior in REBCO magnets.

**Experimental**

We studied ReBCO coated conductors purchased from SuperPower Inc. for use in the 32T user NHMFL magnet system. Utilizing and developing a technique described in Ref.1, a new user-friendly probe was designed to allow Ic(B,T) on 4mm wide tapes up to 700A currents with a standard 15 T, 52 mm bore Oxford Instruments superconducting magnet system. To allow accurate modeling of the 32 T magnet quench, we measured three typical tapes used for the 32T project: low Ic, midrange Ic, and high Ic. Each tape was measured at temperatures from 4.2K to 75K and fields ranging from 1T to 15T in B⊥ tape orientation. For currents over 200 A, pulsed currents were used to prevent overheating.

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|  | **(1)** |



**Fig.1** (Left) Transport Ic(B,T) at B⊥ tape orientation for SP144 SuperPower **4 mm wide** tape measured in

OX III with new variable temperature probe. Fitted curves are matching well with experimental data at T<45K.

(Right) Magnetic field dependence of fitting parameter To(B) compared with data from C. Senatore *et al.* paper [3].

**Results and Discussion**

The Ic(B,T) dependencies were fitted with equation (1) from Ref. 2 and fitting parameters To, Ic\* were found for each tape (see Fig.1 (Left)). For all measured samples Ic(B,T) followed well the dependence (1). After the maximum value, To(B) monotonically decreases with the field (Fig.1 (Right)). Tapes with different Ic have different To max. For R&D tape To-B slope is smaller than for production line tapes. The position of maximum in To(B) graph correlates with BZO density. Tape with smallest BZO density (and therefore smallest in-field Ic) SP144 has the largest To max showing at low field B=2.8T. To maximum shifts to higher fields for tapes with higher BZO density.

**Conclusions**

We succeeded in measuring Ic(B,T) on full-width modern ReBCO tapes, an important part of the quench modelling by Andy Davrilin. The fitting parameter To is in good agreement with data obtained by another group [3]. We plan to use correlations between fitting parameters of extensive Ic(B,T) data set, and Ic(4.2K,B) data to predict Ic(B, T) for any tapes purchased for magnets beyond 32T.

**Acknowledgements**

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**References**

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[2] G. Blatter, *et al*., *Rev. Mod. Phys.*, **66**, no. 4, 1125–1388 (1994);

[3] Senatore, C., *et al.*, *Superconductor Science and Technology,* ***29* (1)**, 014002 (2015).