

Coated conductors being used at the NHMFL are (not yet anyway) uniform

Data provided by Dmytro Abraimov (32 T testing), and further selected samples by Lidia Rossi, Xinbo (Paul) Hu Jan Jaroszynski and Tak Kametani

David Larbalestier

Data taken from D Abraimov(WAM-HTS Hamburg talk) and Lidia Rossi (MS thesis, University of Paris Marie Curie, June 2014 with stage at NHMFL Jan-Jun 2014)



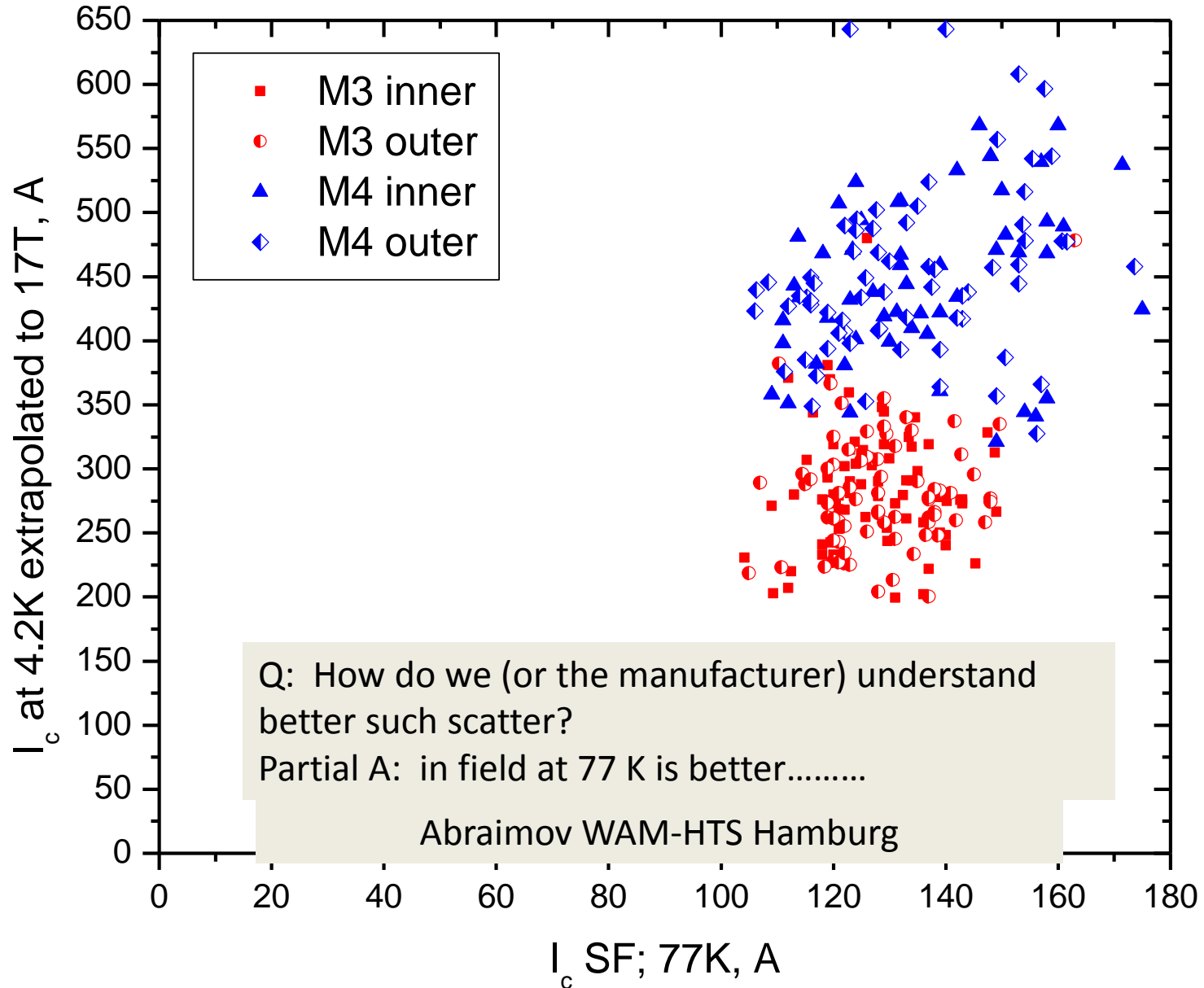
The 2014 Kyoto Workshop on HTS Magnet Technology for High Energy Physics

– The 2nd Workshop on Accelerator Magnet in HTS –
November 13 – 14, 2014, Kyoto, Japan

Simple points

- Procurements have taken place over about 3 years
- SF 77K is not sufficient to specify conductor for any of our high field coils
- We have invested strongly in characterization capabilities
- Many variations are seen, more than those whose cause is understood!

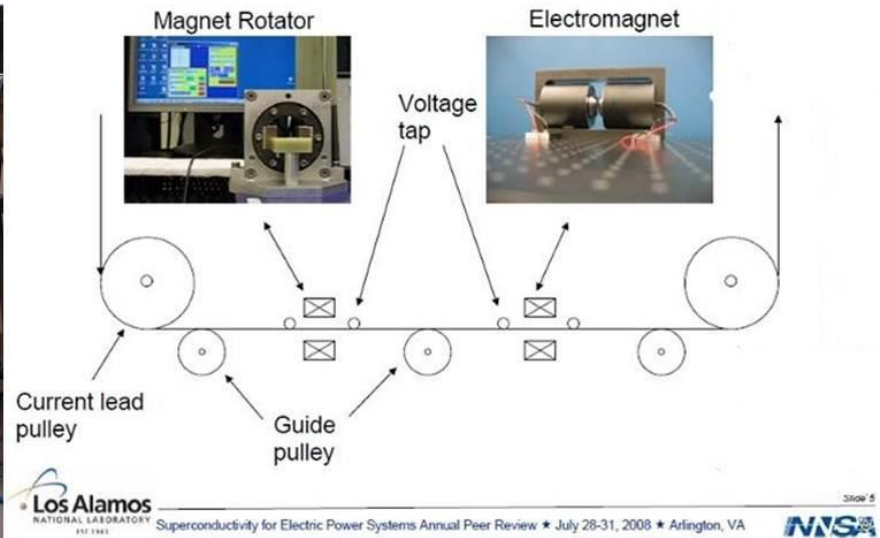
Self field 77 K does NOT provide good prediction of 4 K high field properties



(a)



(b)

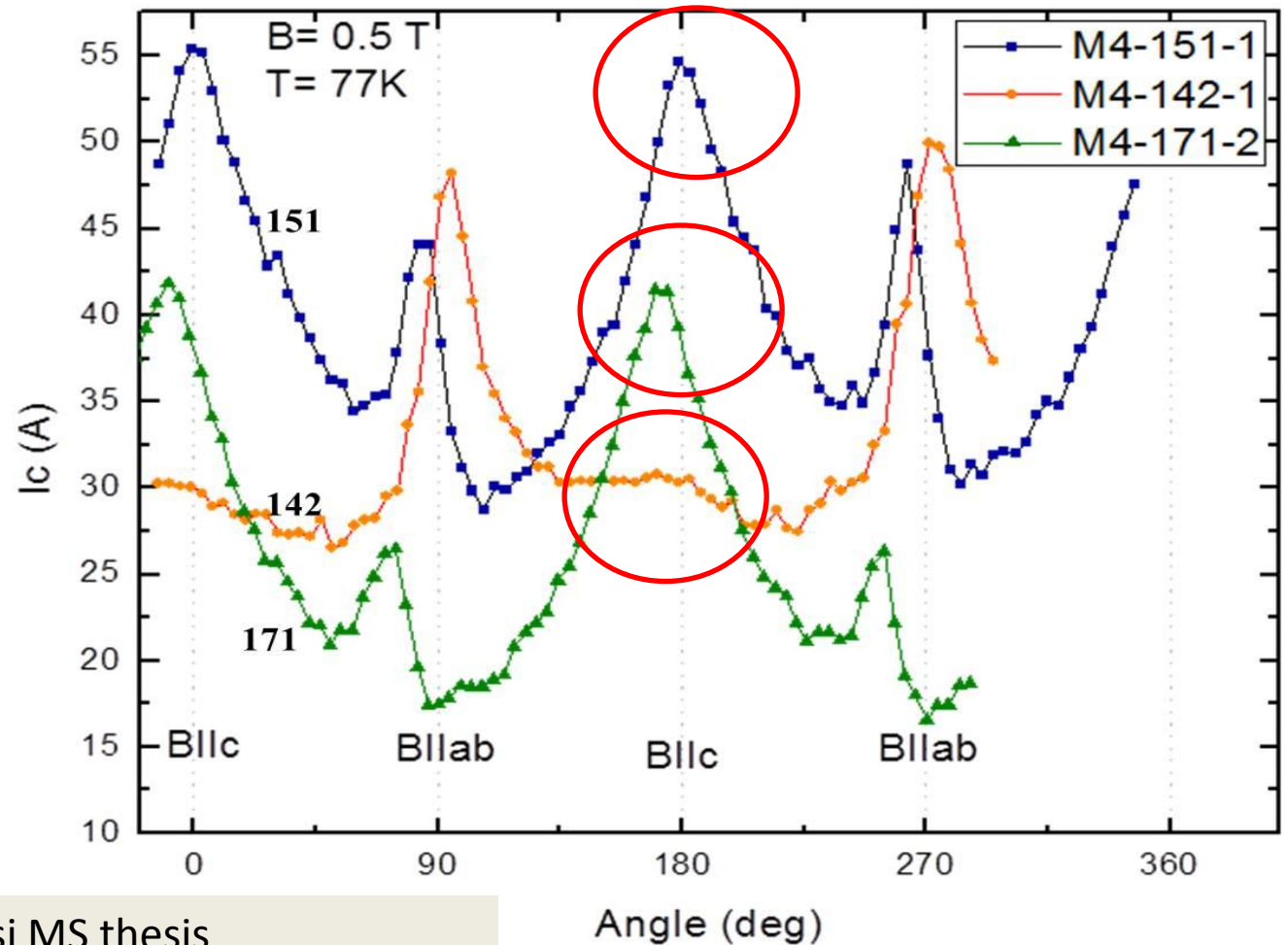


SuperPower Label	I_c (A)	Length (m)	Width (mm)	Thickness (mm)
M4-151-1 MS (163-172m)	156	9	4.00	0.092
M4-142-1 BS (275-285m)	94	10	4.05	0.097
M4-171-2 FS (1487.65-1497.65m)	96	10	4.00	0.094
M4-171-2 FS (1537.65-1547.65m)	97	10	4.00	0.094
M4-153-3 BS (107.11-117.11m)	97	10	4.00	0.093

Lidia Rossi MS thesis

Select 5 from 100....

SuperPower Label	I_c (A)	Length (m)	Width (mm)	Thickness (mm)
M4-151-1 MS (163-172m)	156	9	4.00	0.092
M4-142-1 BS (27				
M4-171-2 FS (1487.6				
M4-171-2 FS (1537.6				
M4-153-3 BS (107.1				



TEM by Fumitake Kametani

M4-151

500 nm

200 nm

M4-171

M4-142

500 nm

Conductor I_c at 0.5 T, 77 K	M4-151	M4-171-4	M4-142	Comment
B parallel ab	44 A	26 A - lowest	47 A - highest	
B parallel c	55 A - highest	42 A	30 A - lowest	
microscopy	Dense c-axis BZO and ab-plane Re2O3	Fewer BZO c rods and many fewer ab-plane Re2O3	Few c-axis BZO nanorods with dominant ab plane ppts.	

Conclusion

- Both extrinsic and intrinsic defects control I_c in coated conductors and both types are present.
- In situ REBCO growth, especially with strong vortex pinning defects like BaZrO₃ (BZO) is VERY susceptible to local growth perturbations that affect $J_c(B, T, \theta)$ and $I_c(x)$
- The right tools – multiple ones – are needed to sort them out