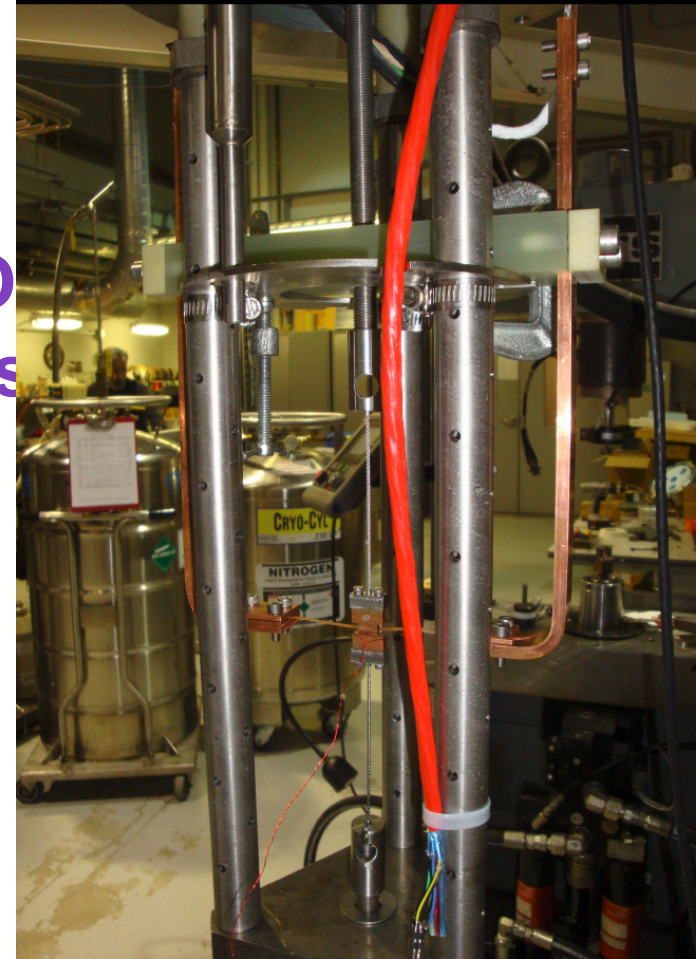




77K Characterization of YBCO Coated Conductors and Joints

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OBJECTIVES:

- Develop reliable, useful test methods for standardized qualification of commercial coated conductors.
- Generate design data by characterizing the electro-mechanical properties of the conductor and soldered joints

TEST METHODS:

1. Displacement Control 77K Axial Tension Tests,

- Generate 77K Stress-Strain Curve
- Strain measured w/ 25 mm Gage Length Clip-on Extensometer

2. I_c vs Strain -Axial Tension Tests (Self field @ $T = 77\text{ K}$),

- Tests of single conductor and lap joint conductors
- Incrementally strain and perform in-situ V-I measurements.

3. I_c vs Strain -C-axis Tension Tests (Self field @ $T = 77\text{ K}$),

- Conductor performance in presence of c-axis tensile stress.
- Incrementally stress and perform in-situ V-I measurements.





MATERIAL:

- YBCO 2G superconducting composite tape produced by Superpower Inc.
- Conductors with variable thickness copper stabilizer
- High strength/high modulus Hastelloy ribbon substrate

Conductor ID	Approx. Ic, T = 77K, B=0T [A]	Avg. X-section width x thk [mm]	Avg Cu.thk/side ** [mm]	Cu Area / Hastelloy Area
SP20	130	4.09 x 0.10	21	0.98
SP18	99	4.12 x 0.12	33	1.48
SP07	102	4.13 x 0.13	40	1.73
SP26	124	4.15 x 0.155	50	2.18

** Cu thickness = average tape thickness - nominal hastelloy thickness.

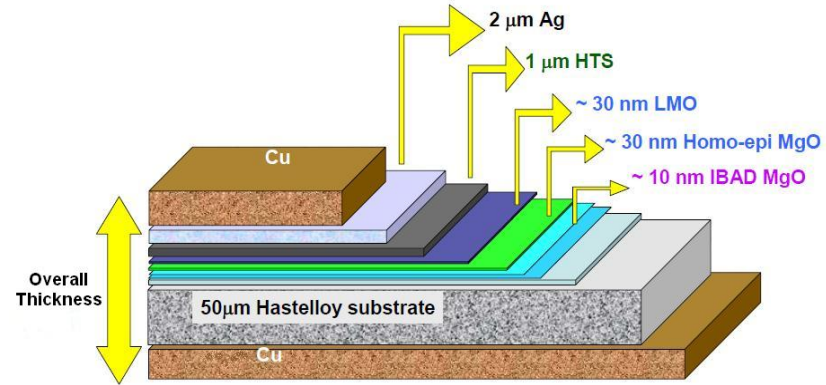
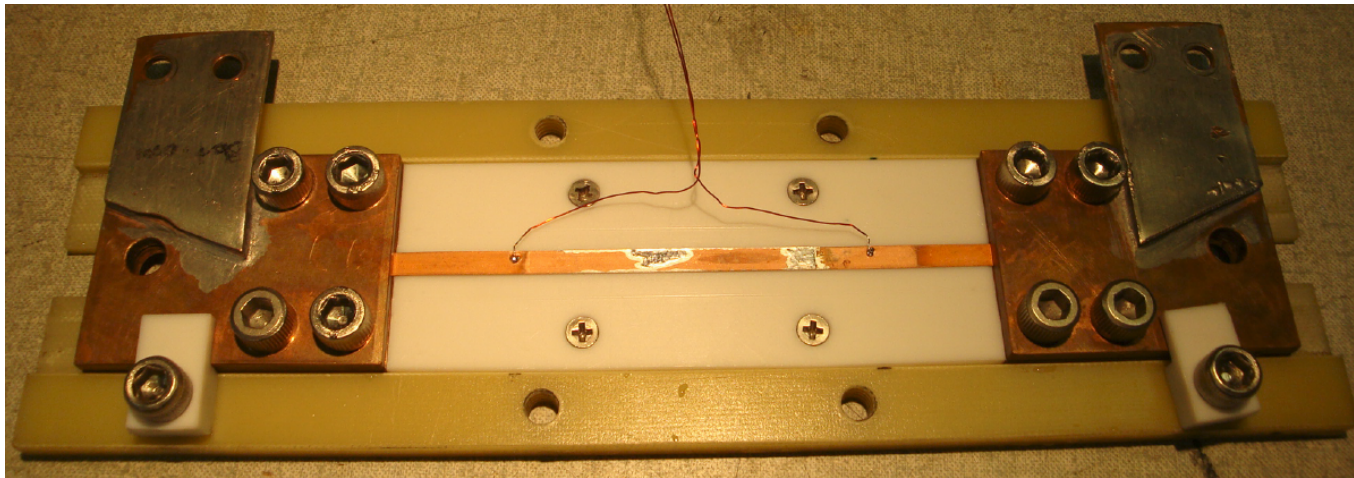


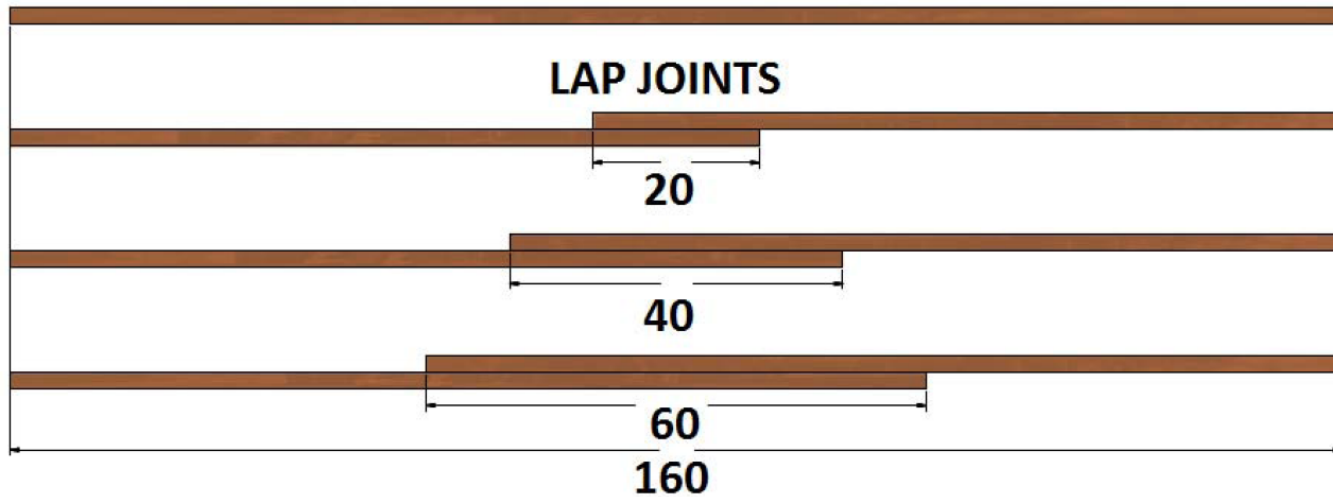
FIGURE 4: End view photo of SP07 conductor shows Surround Cu Stabilizer (SCS) and Hastelloy substrate.



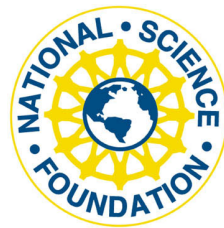
Axial Test Specimen Designs



STRAIGHT

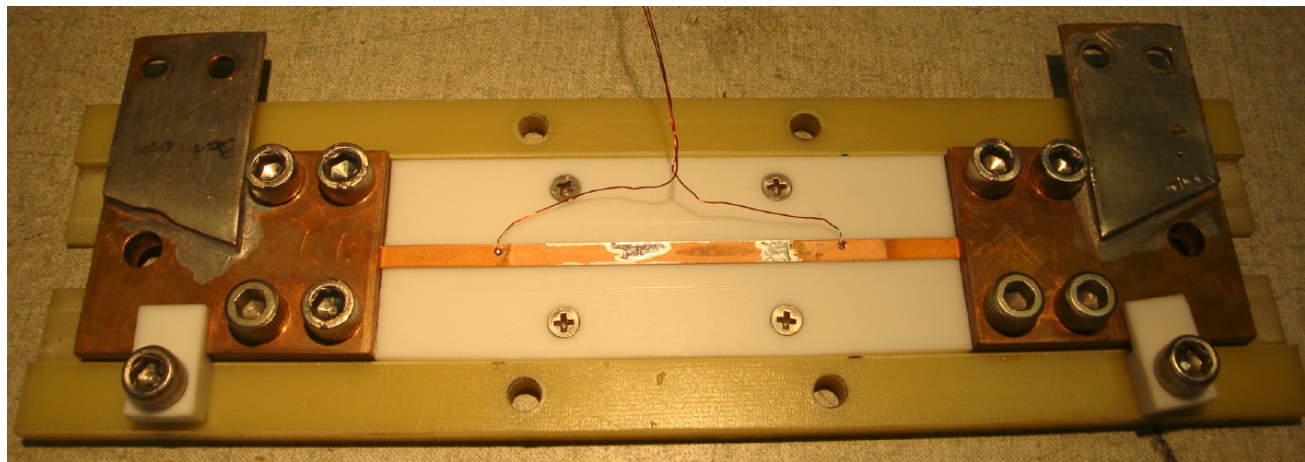


Sample Geometry and
Dimensions (side view)

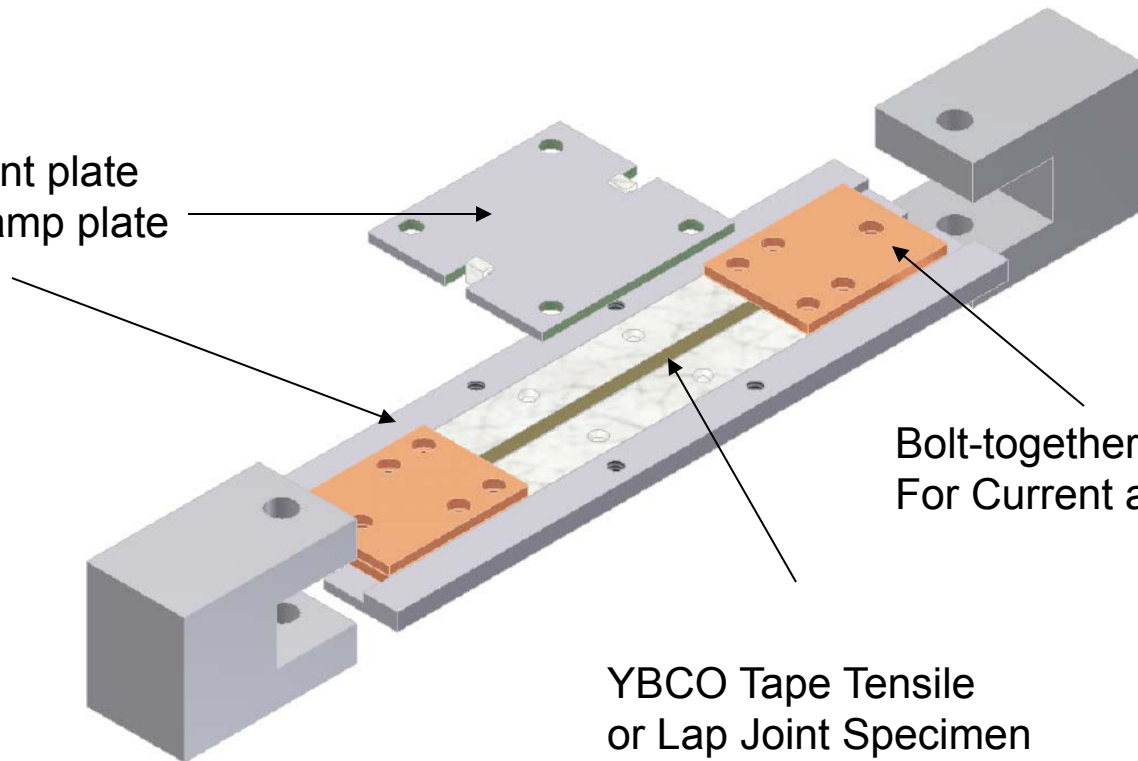




Ic vs Strain Test Rig



G-10 alignment plate
and Teflon clamp plate



Bolt-together Cu Grips
For Current and Force application

YBCO Tape Tensile
or Lap Joint Specimen





77K Tensile Stress-Strain Curves

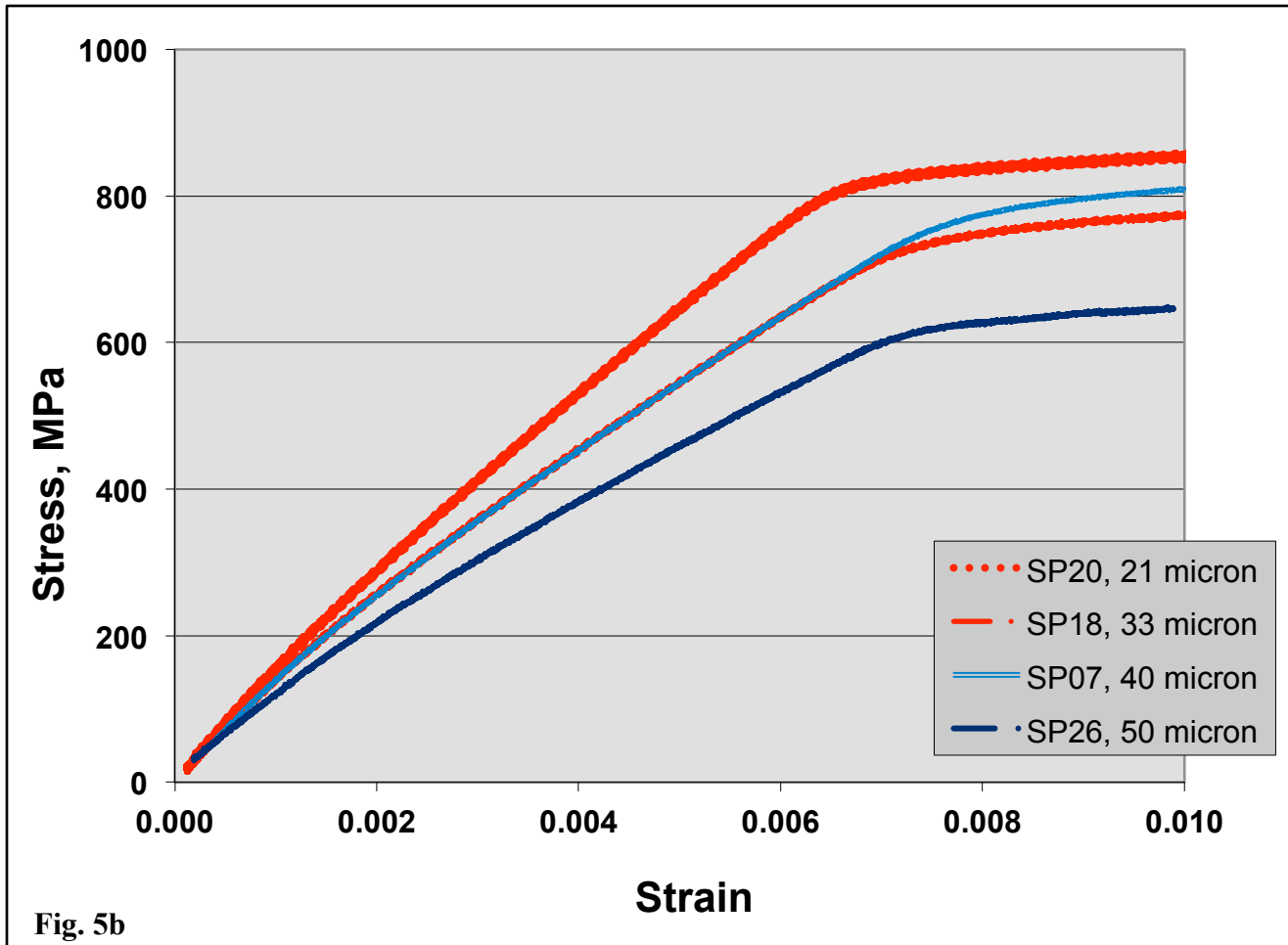
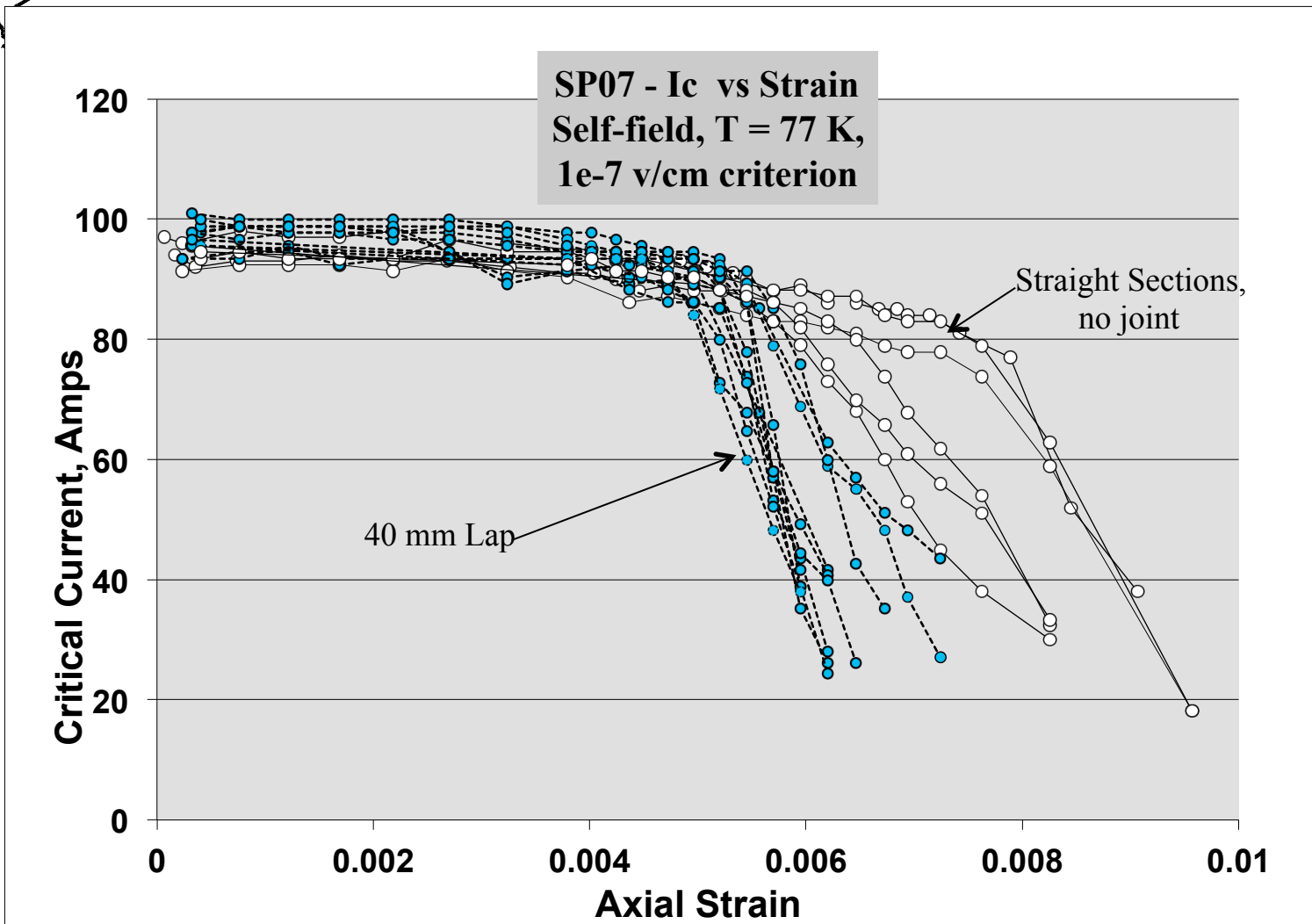
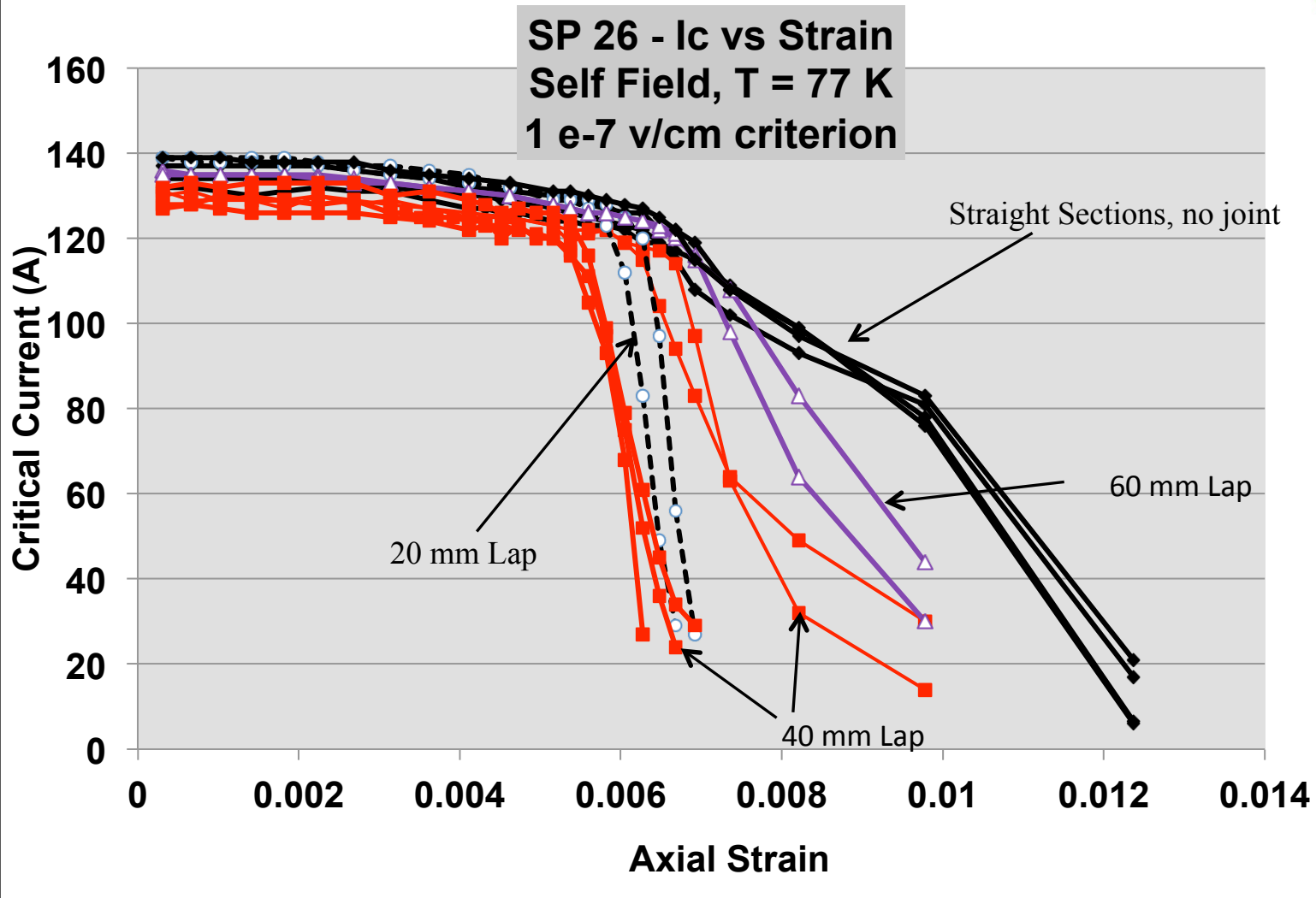
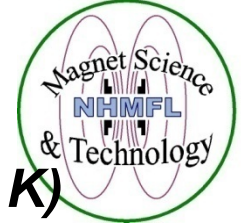


FIGURE 5b: Measured 77K tensile data on the 4 conductors.

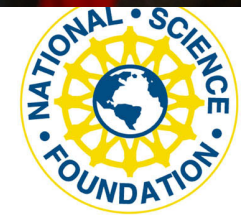
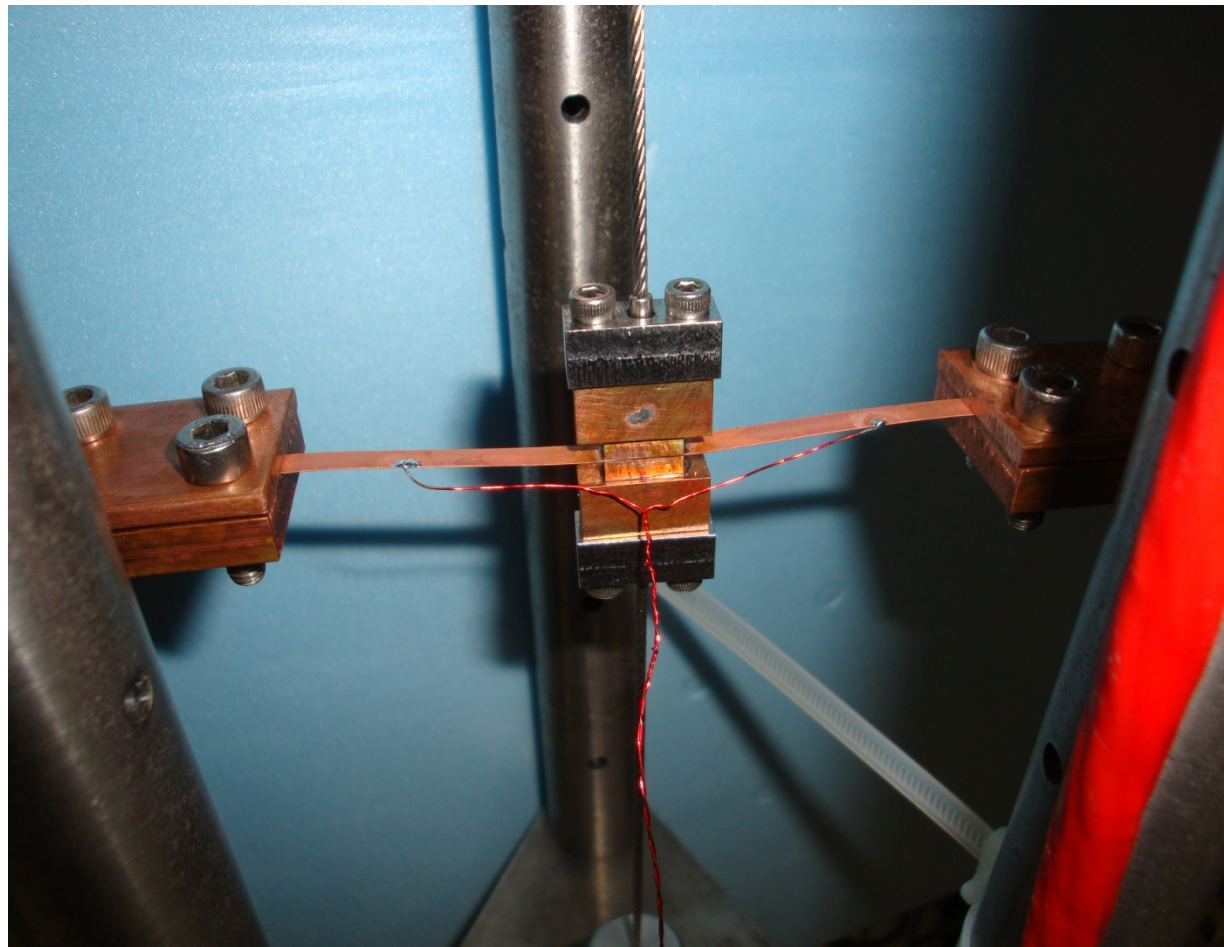








I_c vs Strain - Transverse Tension Tests (Self field @ T = 77 K)





C-axis Tensile Stress - Ic Results

Conductor	Copper Anvil Dimensions (mm)	Spec	Initial Ic , zero stress	Ic at Max Applied Stress	Max Applied Stress	Comment
	Width x Length		Amps	Amps	MPa	
SP26	4 x 10	1	132	132	72	Max'd out Force capability
	3 x 5	1	127	127	22	Anvil solder failed
	3 x 5	2	127	127	28	Anvil solder failed
	3 x 3	1	118	118	72	Anvil solder failed
	3 x 3	2	82	82	14	Anvil solder failed
SP14	3 x 5	1	102	102	56	Anvil solder failed
	3 x 5	2	92	92	80	Anvil solder failed
	3 x 3	1	82	82	52	Anvil solder failed
	3 x 3	2	100	100	60	Anvil solder failed

Problem Conductor used in a test Coil

Summary:

- 2 conductors have been tested (SP14 and SP26)
- No Ic dependance on transverse stress was observed
- No mechanical failures of YBCO tape

- Test limitations (max stress or grip failure) in all 9 tests resulted in a range of max applied stress before test stopped

