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Bi-2212 Round Wire Performance Continuous Improvement

OST, EUcard2

CERN, June 14, 2013

Acknowledgements

- U.S. DOE – VHFSMC, High Energy Physics CDP, BSCCo & SBIR programs
- ASC - Florida State University, Lawrence Berkeley National Laboratory

Fermi National Accelerator Laboratory and Brookhaven National Laboratory

Mono-core wire densification by swaging

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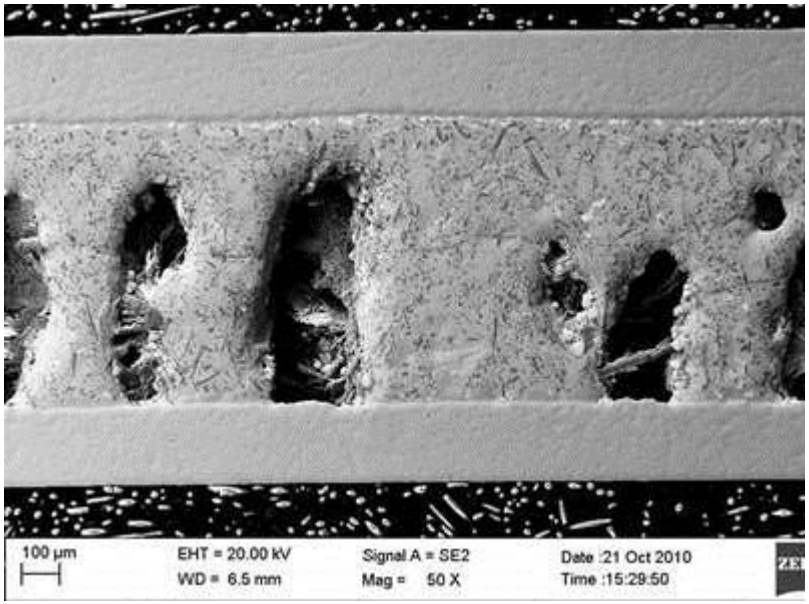
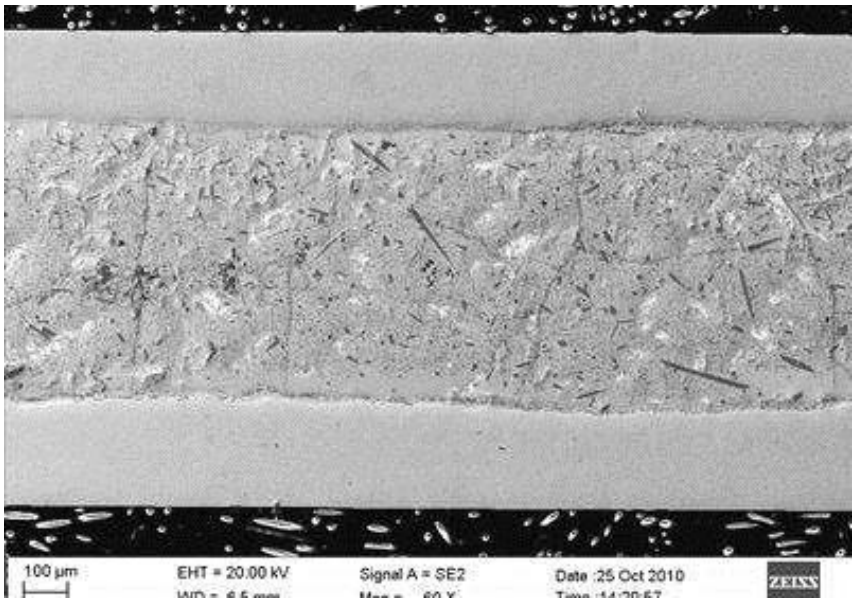
Quenched samples right after melt treatment at 890°C



Quenched from melt as-drawn mono filament, initial core density ~70%

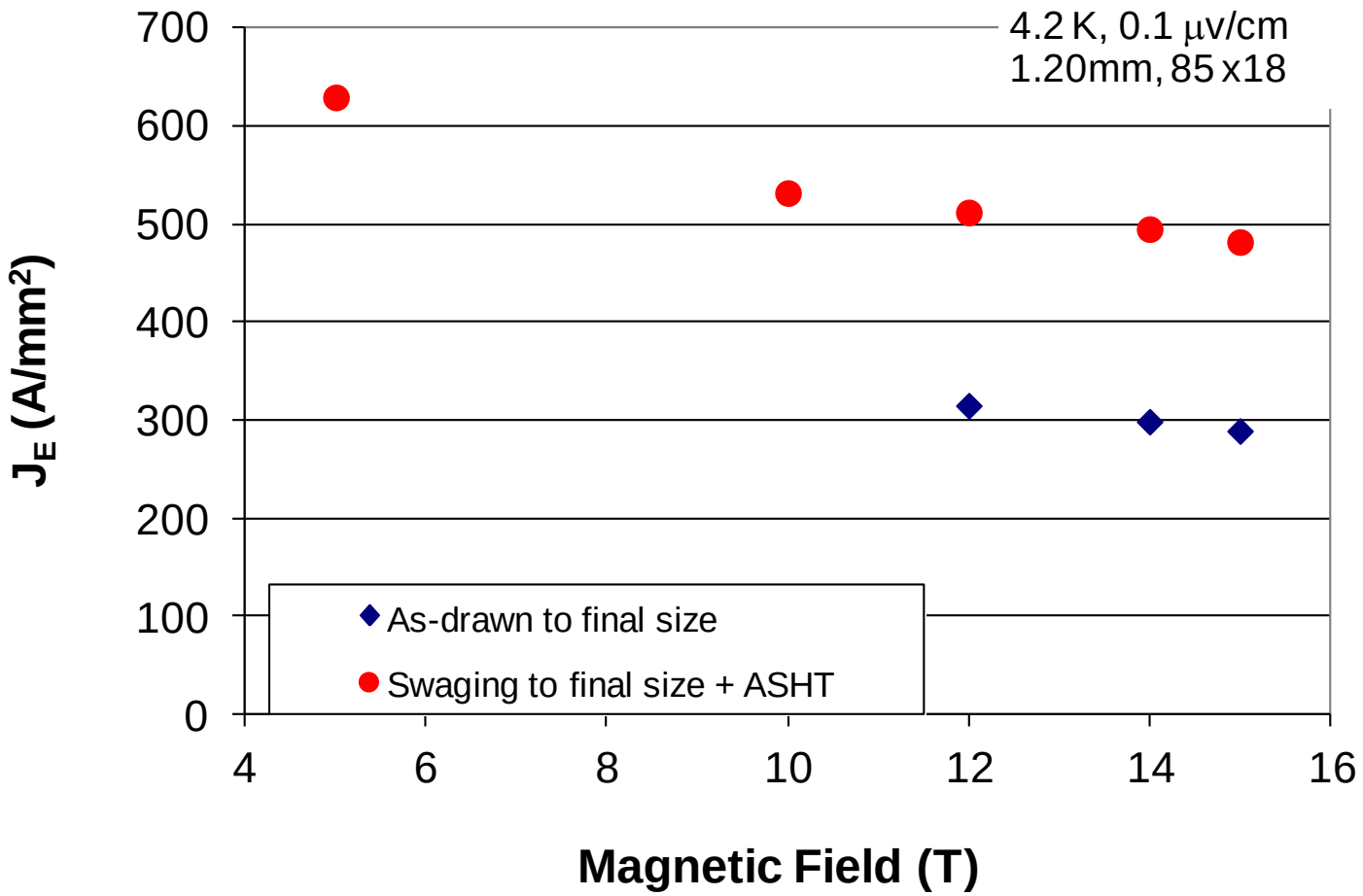


Quenched from melt swaged mono filament, initial core density ~90%

Pictures courtesy of ASC/FSU

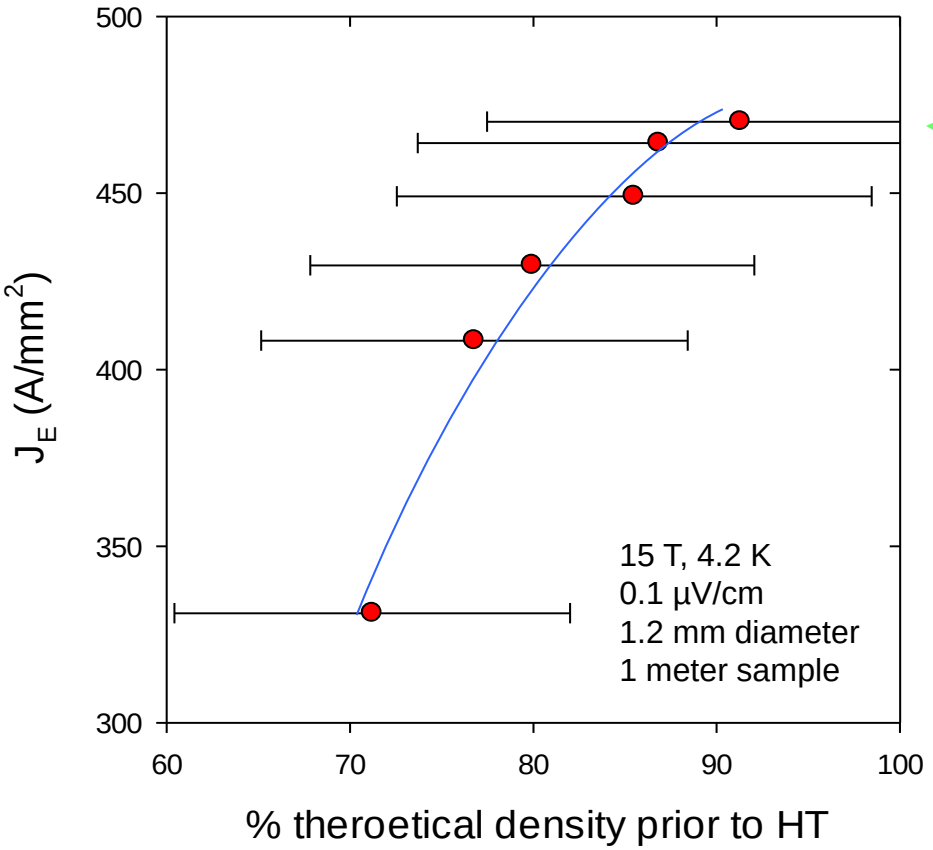
- Large bubbles in as-drawn mono filament
- No obviously large gas bubbles in the swaged filament

J_E improvement by swaging



- The best J_E value is > 480 A/mm^2 at 15 T by swaging

J_E improvement by CIPing up to150 ksi



470 A/mm^2
@ 15 T

- Core densification result in double J_E values to ~470 A/mm^2 at 15 T

J_E improvement by Over-pressure treatment

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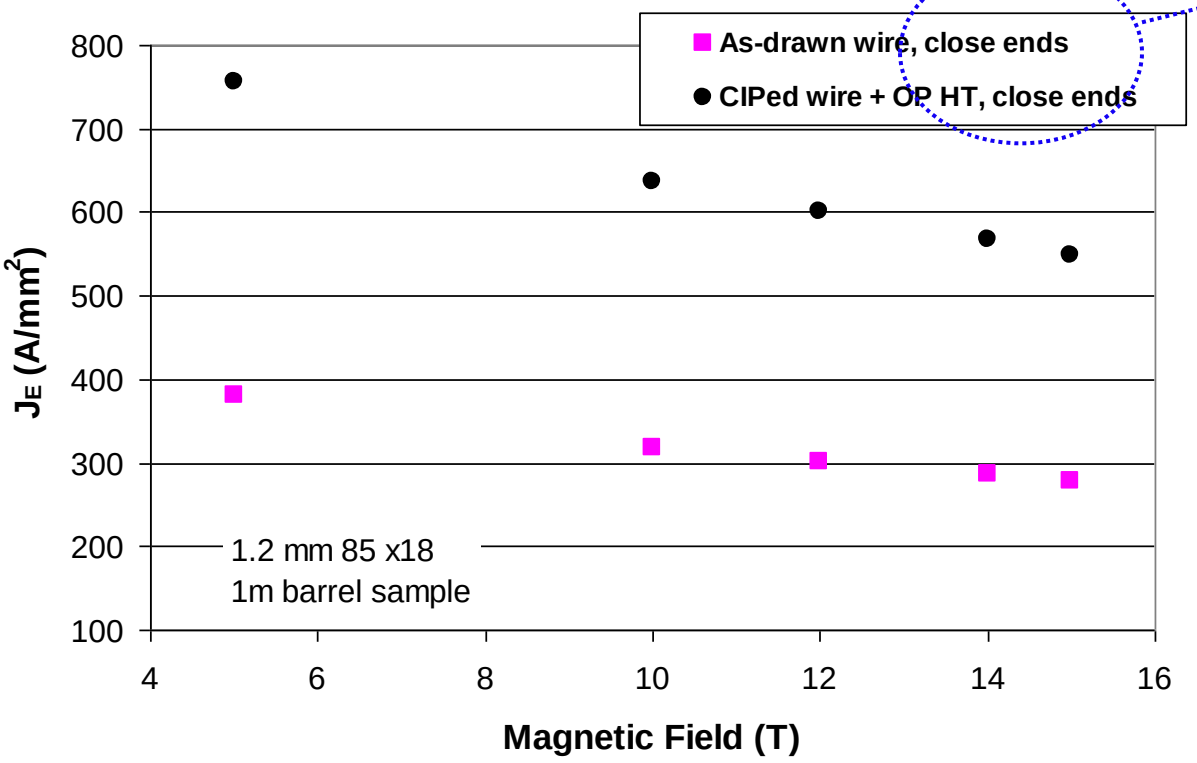
Over Pressure Heat Treatment (10 bar by ASC/FSU)



"Close ends" simulates long length as in a coil

- "Over pressure HT" is to prevent the leakage
- "Core densification + over pressure HT" achieve J_E values to *~550 A/mm^2 at 15 T in 10 bar and meter barrel samples with close ends*

State of art OST wire J_E

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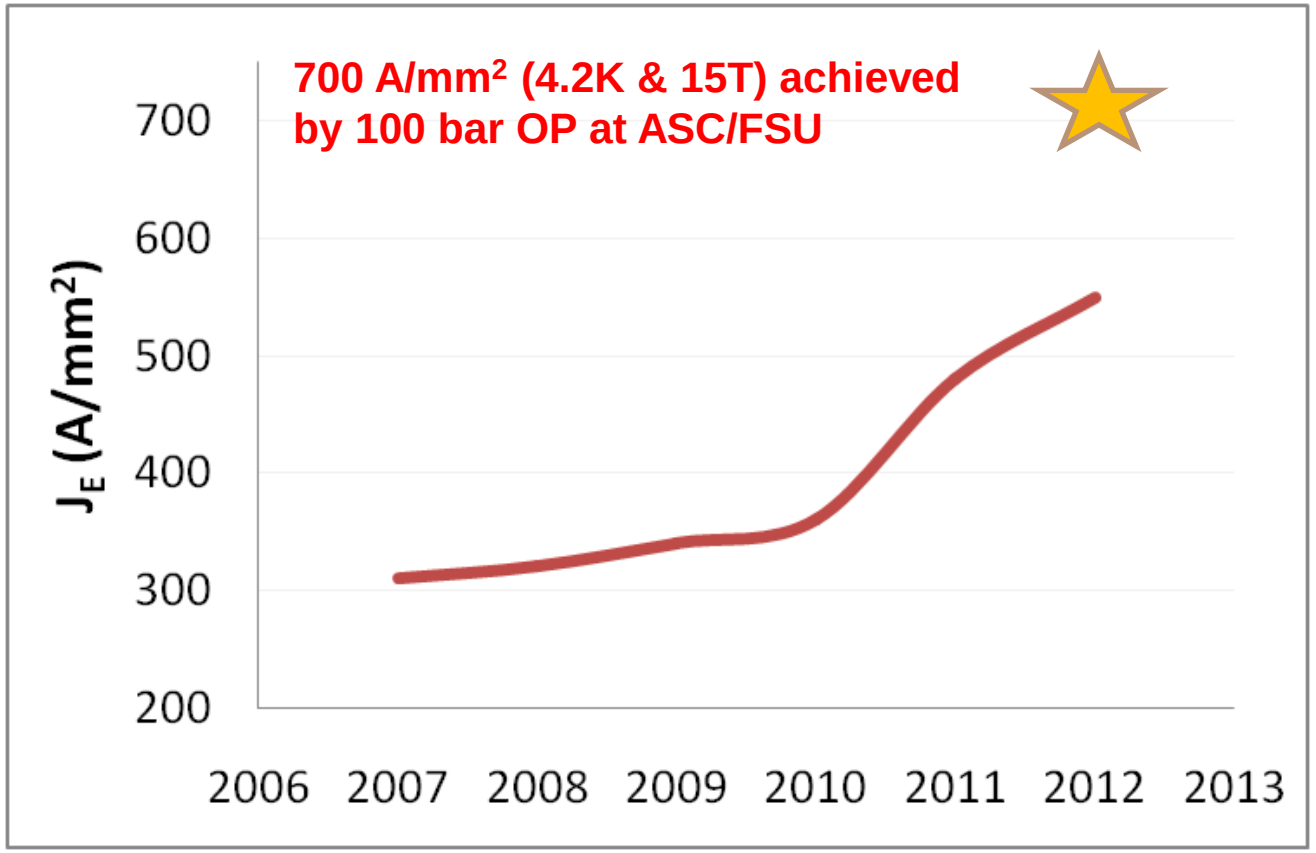
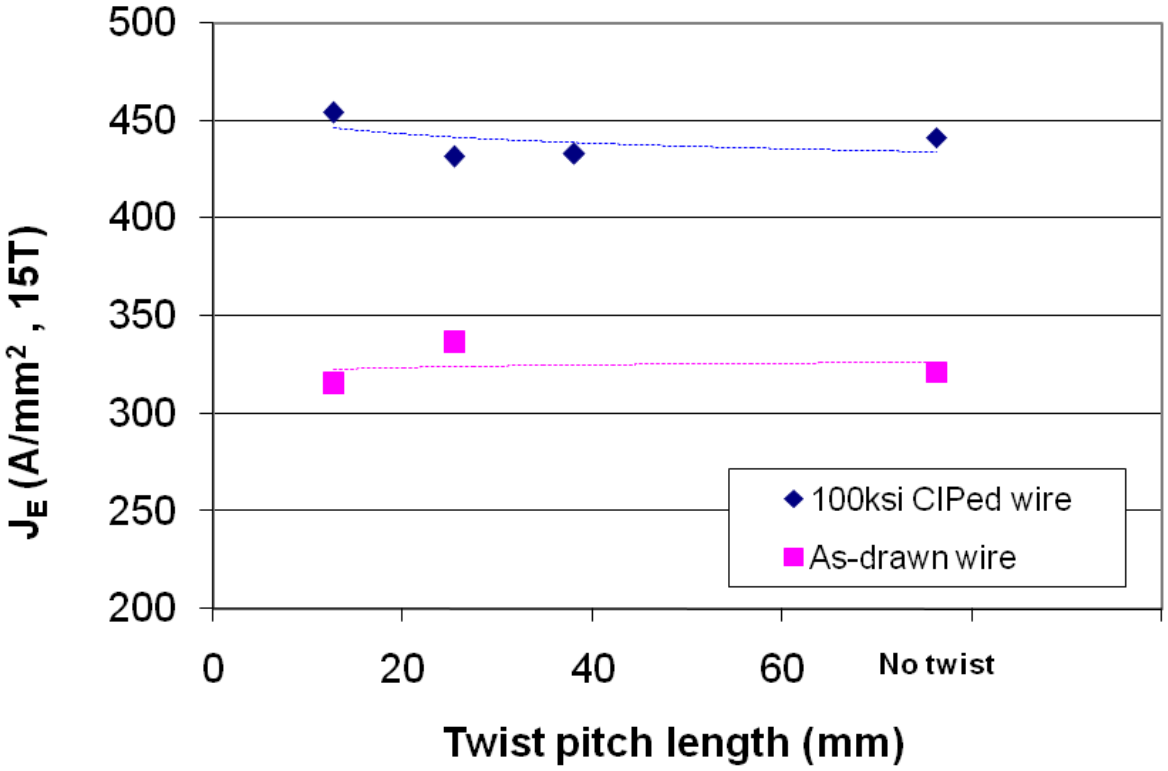
Engineering critical current density (J_E) @ 4.2K&15T, 1.2m sample by leak-free process



- Wire performance continue improving with leakage under control

OST wire can be twisted without degradation!



- Bi-2212 wire can be twisted to 12 mm without significant J_E degradation.

OST round 2212 wire is made in multiple conductor architectures

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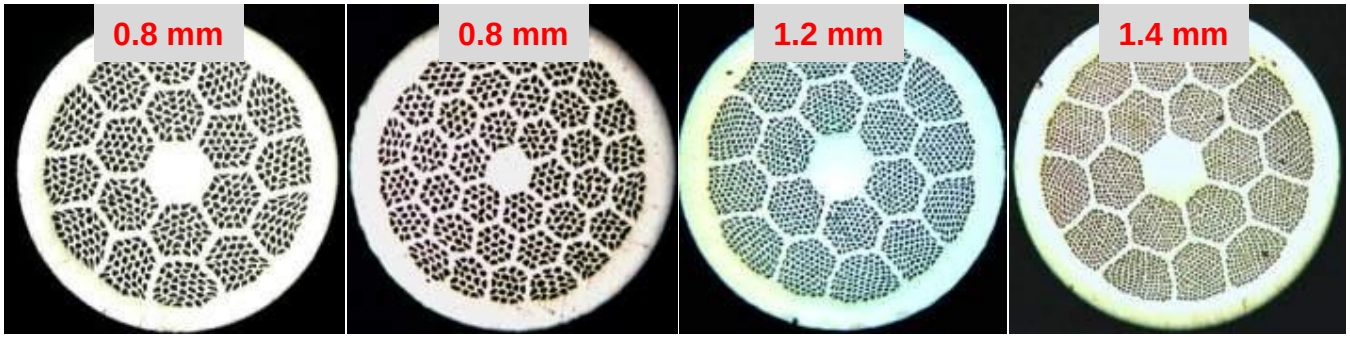
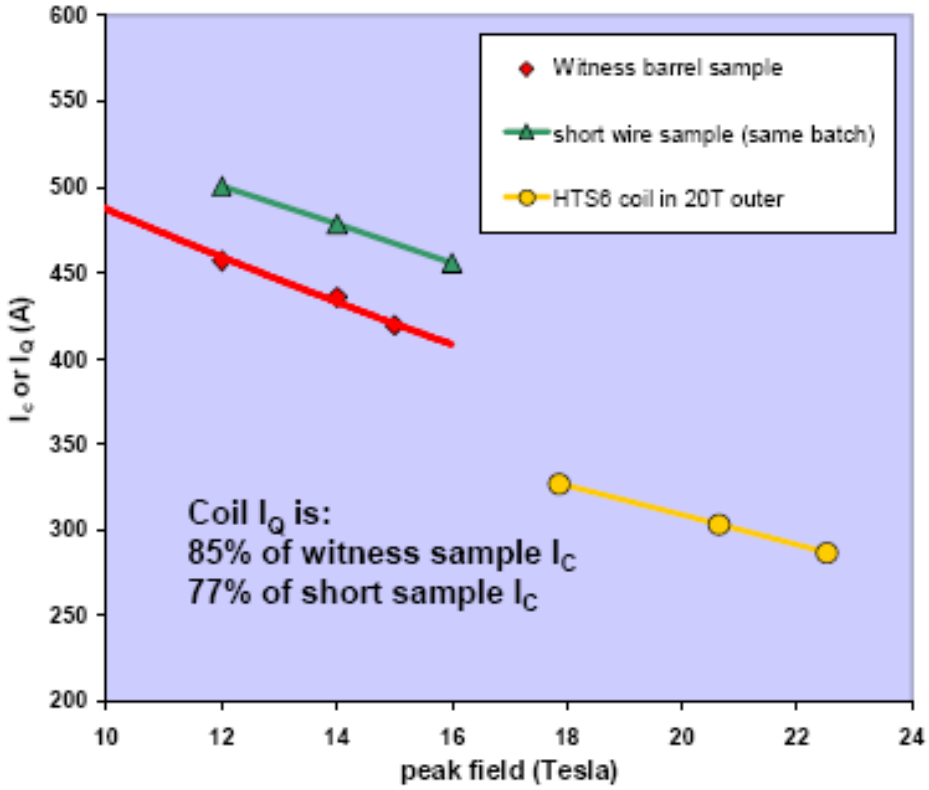
Wire configuration (sub filament number x sub bundle number)	Wire diameter range (mm) @Optimum J_E 4.2K & 15T
19 x 36	0.7 - 1.0
37 x 18	0.7 - 1.0
85 x 18	1.0 - 1.2
121 x 18	1.2 - 1.5



• Various wire configurations to fit different application requirements- Cable (0.8-1.0 mm) and insert Coil (1.0-1.5 mm)

OST coil performance (2009)

- No leakage in the coil with over hundred meter long wire
- Additional 2.25 T generated at 20T background field
- Ic reduction on longer length
  - Lower Ic in coil (15~20%) than the witness sample
  - J_E ~ 200 A/mm^2 at 15T



14 layer coil: 70 od x 25 id x 100 (mm) long

Summary

- OST consistently develop Bi-2212 tape and wire more than 15 years.
- Bi-2212 round wires are fabricated by the standard power-in-tube process
- Wires performance is meeting application requirement s by OP process
- Wire is twistable without Ic degradation
- Various configuration designs for different application

- **Bi-2212 round wire could be fabricated by conventional technology**
- **Many configurations for different applications**
- **Easy to adapt Nb_3Sn well developed technology.**