

## ABSTRACT

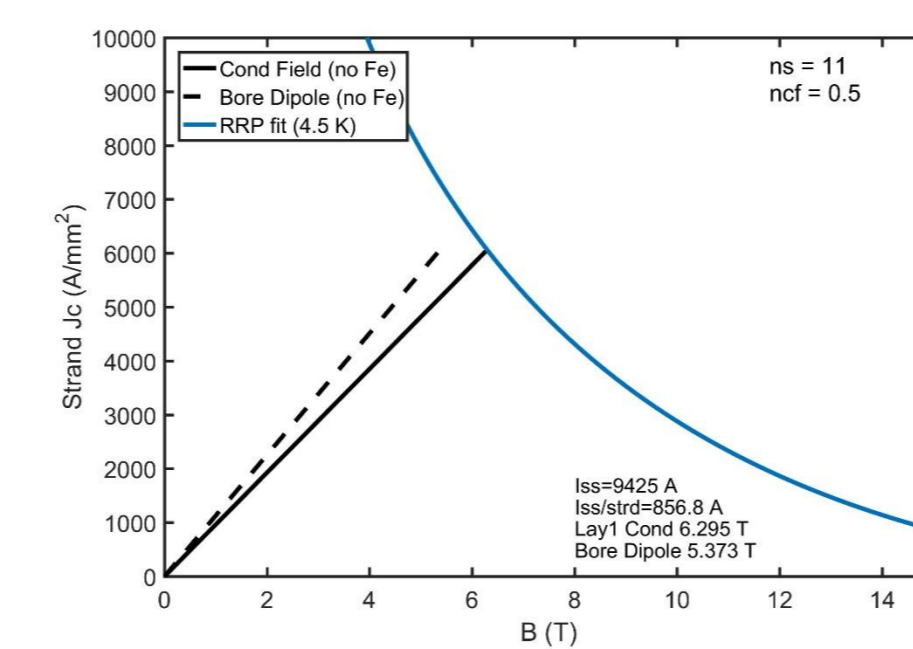
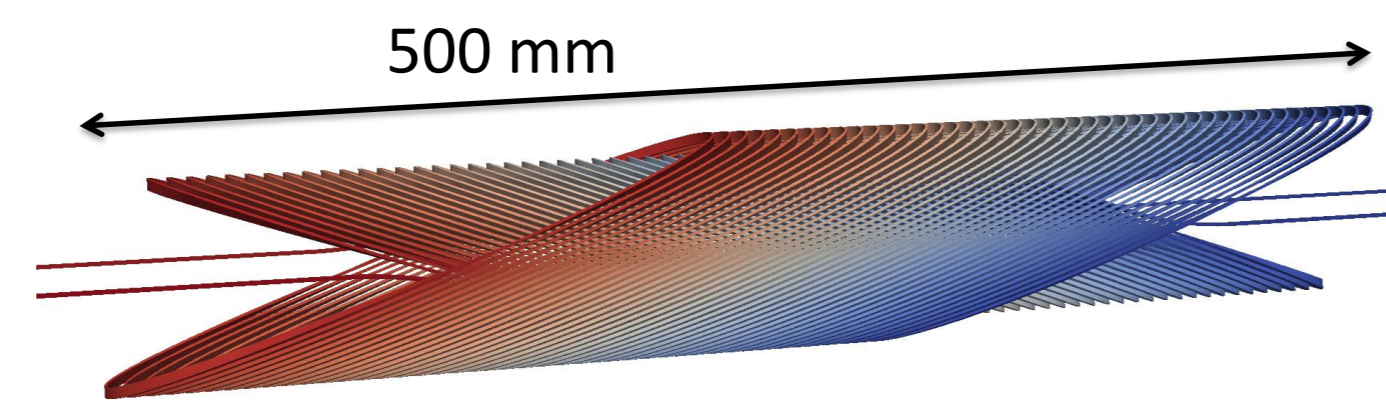
The Canted-Cosine-Theta (CCT) is a design option for high field superconducting dipoles which is being pursued within US-MDP. This poster presents new concepts for eliminating insulation typically placed around the conductor by incorporating it into the winding mandrel. The potential advantages of several different approaches are shown along with initial steps towards demonstrating the concept.

## Motivation and Goals

- Motivation for eliminating glass filled epoxy insulation for CCT's**
- eliminate cracking of brittle epoxy as a source of training at cryogenic temp.
  - reduce the amount of conductor by up to 25% (improved packing factor)
  - clean coils after 650° C reaction (no more carbon from glass sizing)
  - opportunity for using solder or low melting point metals as impregnation material (higher thermal conductivity and better mechanical properties)

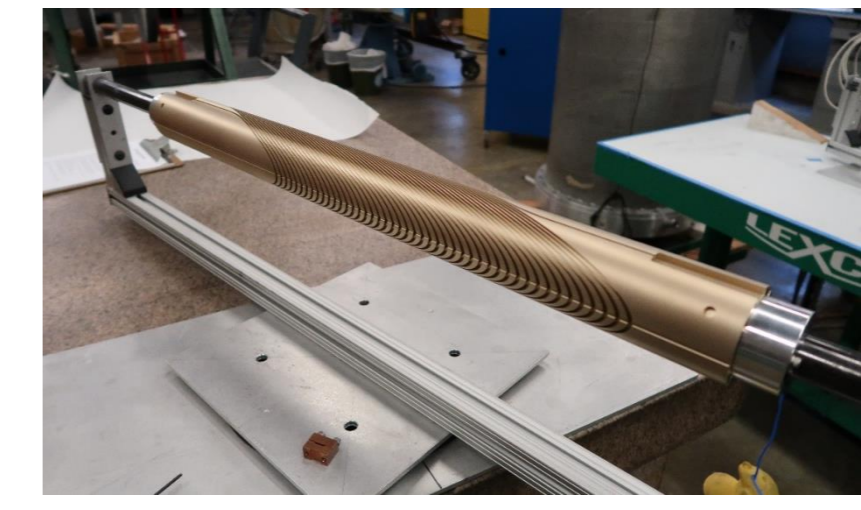
## The Nb<sub>3</sub>Sn CCT Subscale Program at LBNL is Being Used to Test Two Options for a No-Insulation CCT

Baseline design is two CCT Nb<sub>3</sub>Sn layers producing 6.3 T in 50 mm aperture at 9.4 kA short-sample



The goal of the subscale program is technology development with fast turn around and high throughput, see D. Arbelaez [Thu-Af-Or24-06](#)

Layers wound with 11 strand cable of 0.6 mm RRP wire



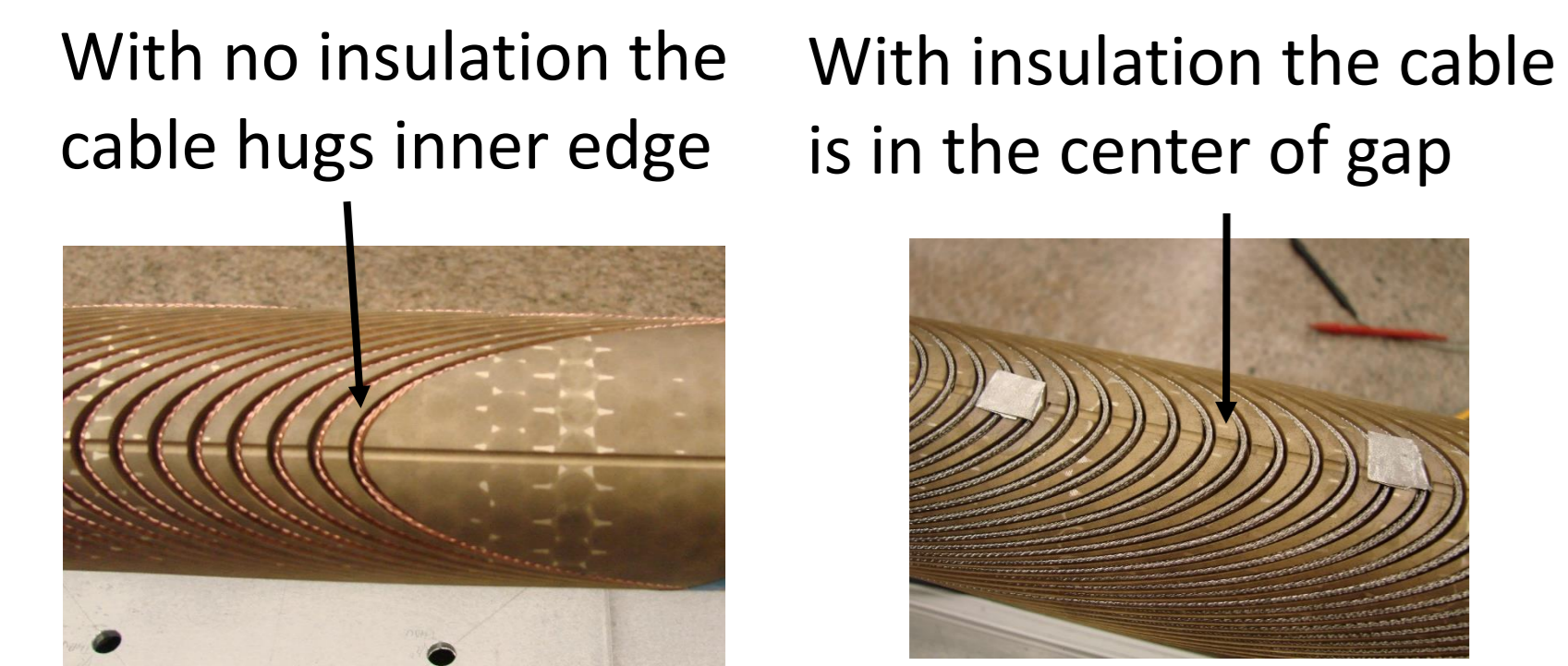
Single layer impregnation



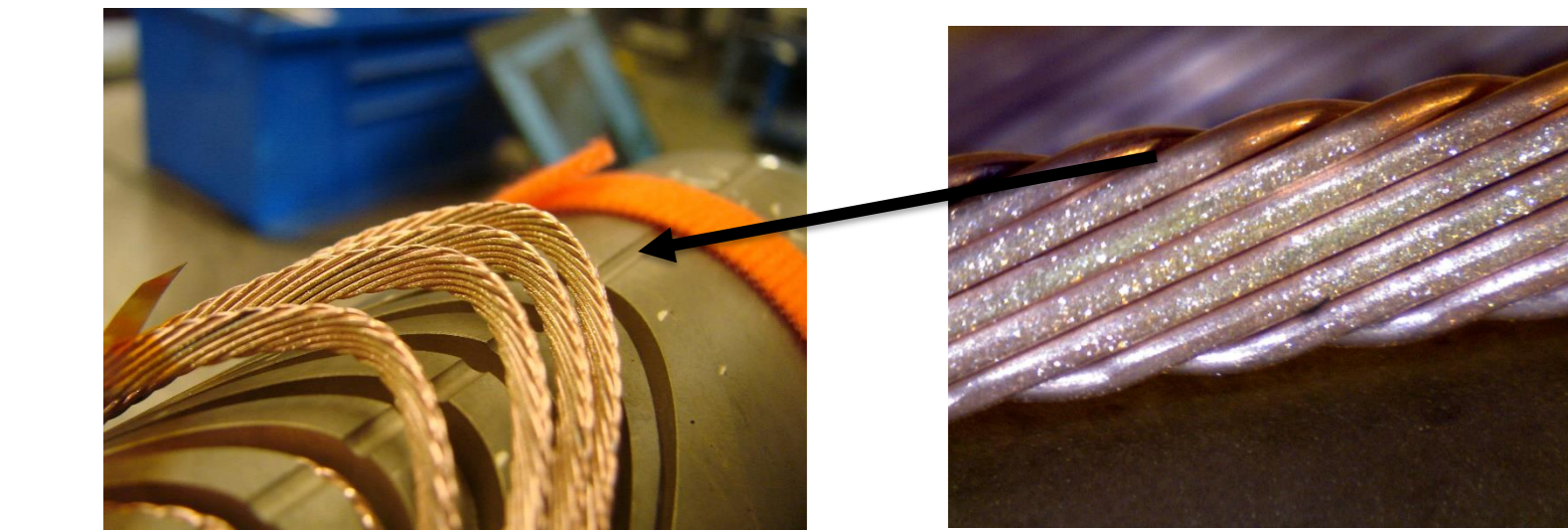
Assembly with inflatable shims



## Reaction Tests with no Insulation Show Sintering to the Mandrel

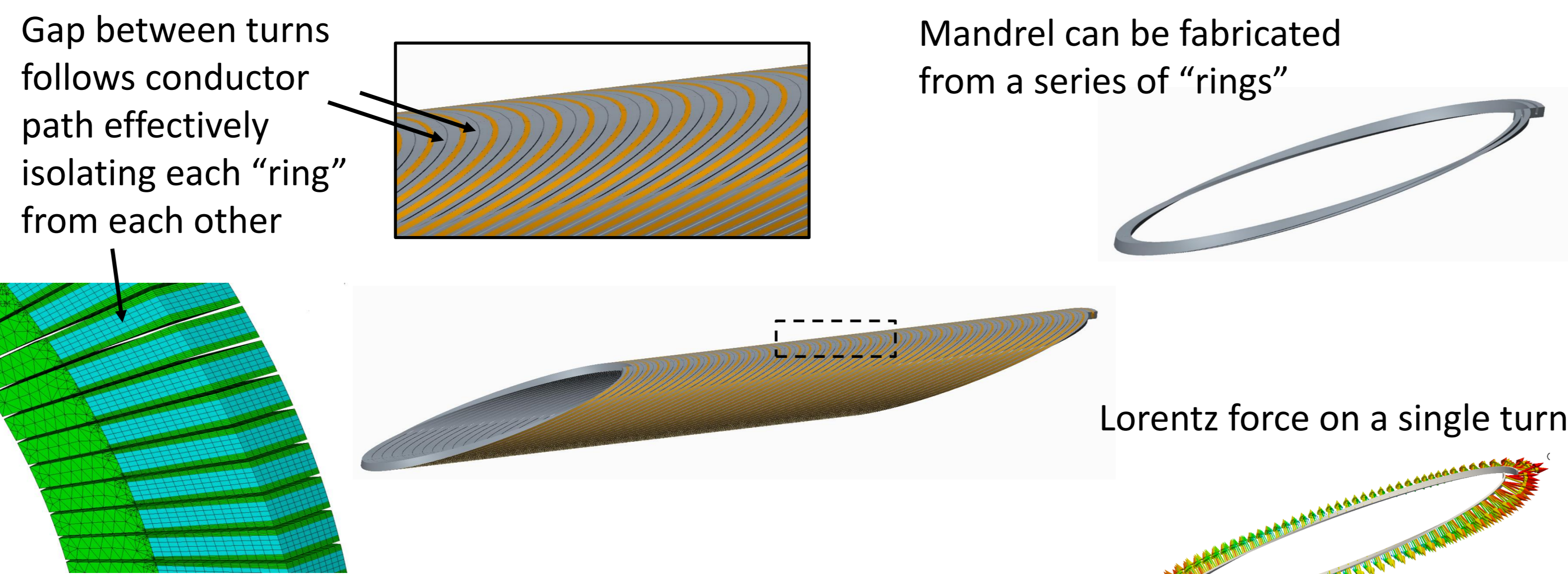


Evidence of "sintering" to the bronze mandrel on the inner edge with no insulation

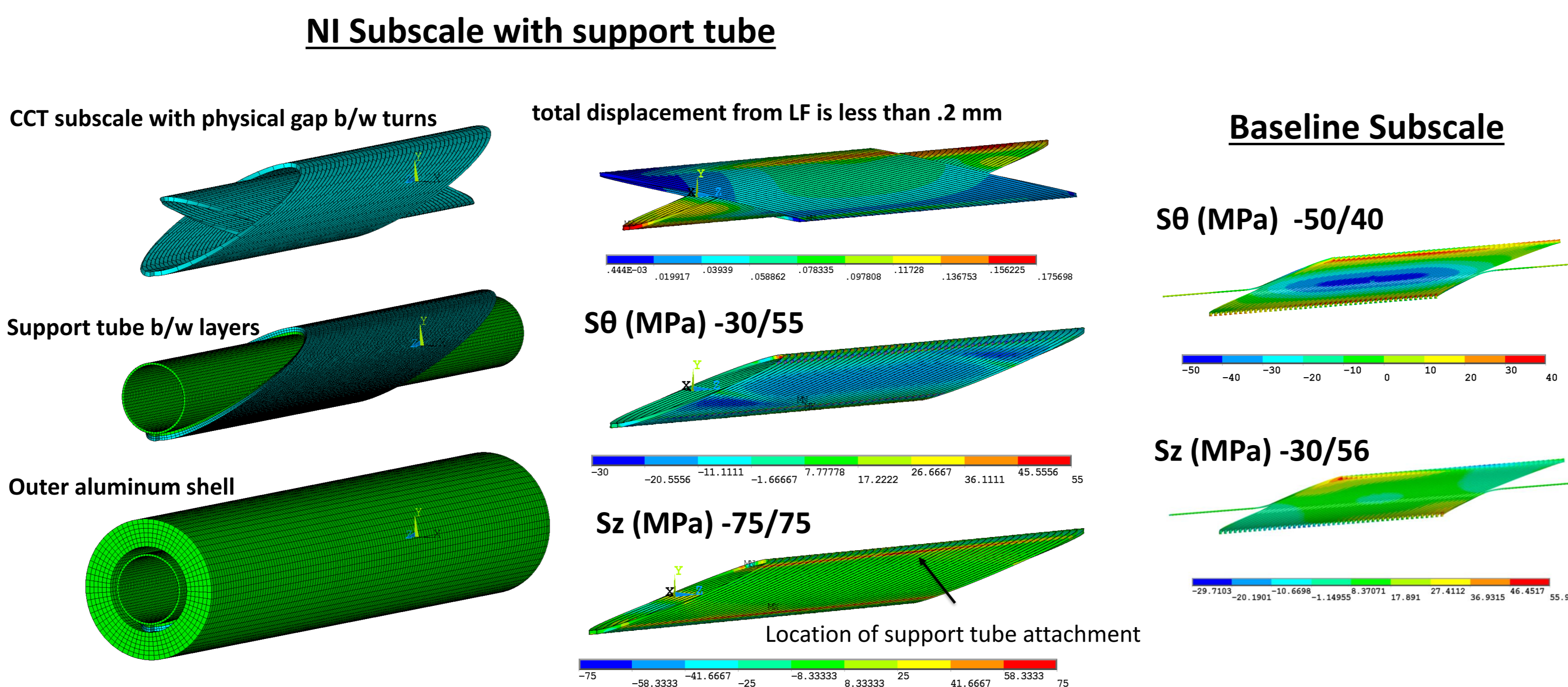


Next reaction test will incorporate mica or other standoff method to prevent sintering

## Option 1, Physical Separation: Design and First Prototyping of a Subscale Coil with Physical Break Between Turns is Complete



ANSYS shows required stiffening of mandrel can be provided by a support tube



## Option 2, "Wind-React-Wind" (WRW) with an Insulated Mandrel

A First "Wind-React-Wind" Process Performed for a Single Nb<sub>3</sub>Sn CCT Subscale Coil (S. Caspi)

### Comparison

Turn to turn isolation with no impregnation

✓ ✓

No handling of reacted Nb<sub>3</sub>Sn

✓ ✗

No reduction in mandrel stiffness

✗ ✓

No reaction warpage in final mandrel

✗ ✓

Wind and react on bronze mandrel with no insulation



Extract conductor and place on temporary tooling



Re-wind into an anodized aluminum mandrel

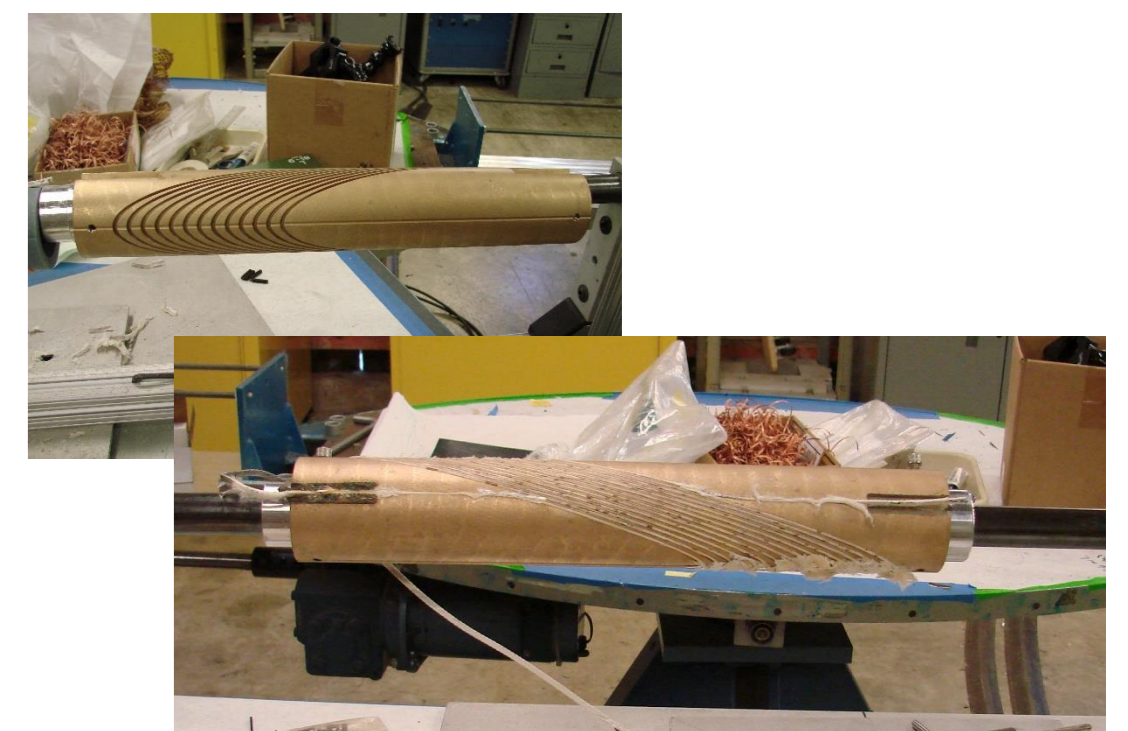


Pot then test: fill does not have to be insulating material

or Test un-potted

## "Wind-React-Wind" for Bi2212 (L. Garcia Fajardo)

Reacted on bronze mandrel



Transferred to 3D printed Accura Bluestone mandrel



Tested un-potted in LN (77K), LHe (4.5 K) test planned



see L. Garcia Fajardo [Fri-Mo-Or25-04](#) for more details and test results