



U.S. MAGNET
DEVELOPMENT
PROGRAM

Status Report on the CORC Coil Program

Ramesh Gupta, BNL

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U.S. DEPARTMENT OF
ENERGY

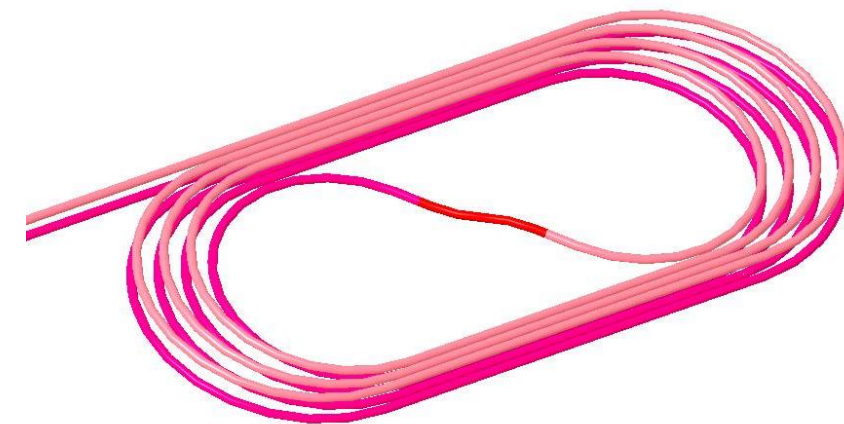
Office of
Science

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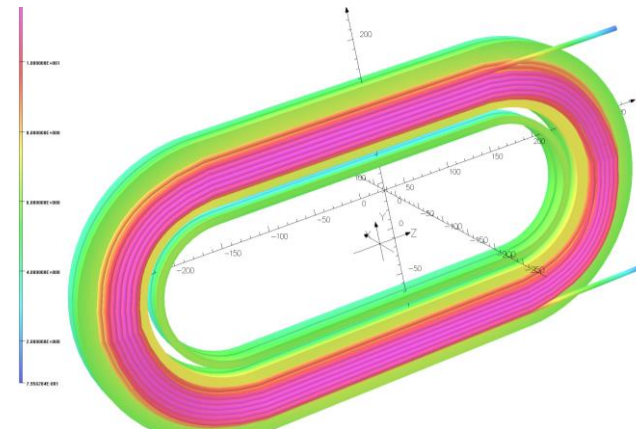
- **Status of the preparation of MDP test for “in-field quench studies of a long CORC cable” in the background field of common coil dipole**
- **A possible opportunity of more complete HTS coil studies thanks to the opening offered by the upcoming USMDP PSI test**

Two Related R&D programs. Magnet Design Program (MDP) and Small Business Technology Transfer (STTR)

- **MDP: “In-field quench studies of a long CORC cable” in the background field of common coil dipole via one 8-turn HTS coil (S-turn in to flip the polarity)**
- **STTR: “Demonstration of a high field HTS/LTS hybrid dipole” with two sets of double pancake coils made with 6+8 turns (total 28 turns) of CORC cable**

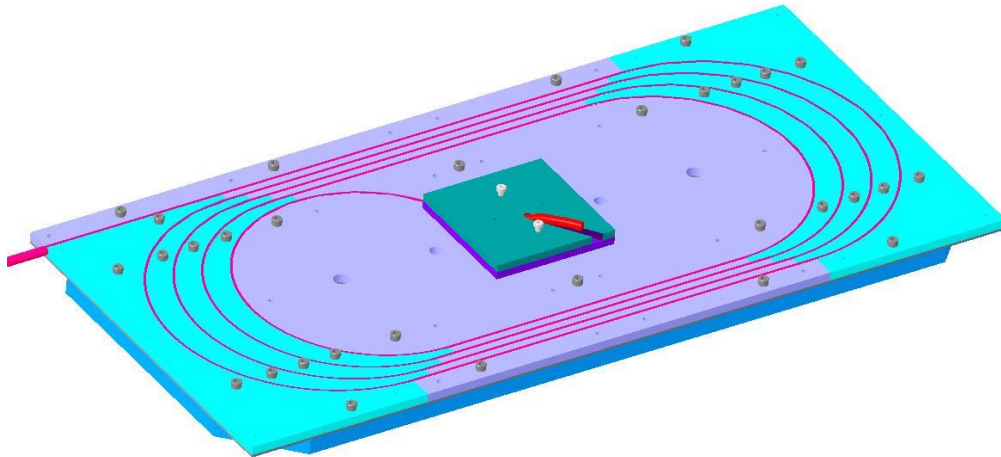
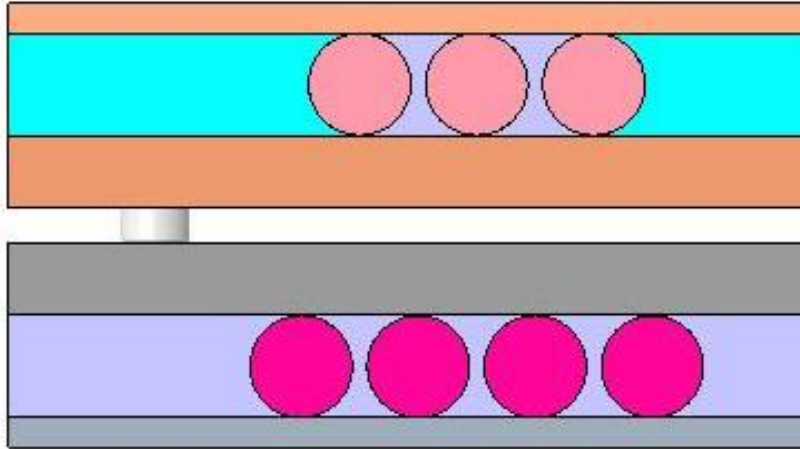


MDP:
Quench studies &
technology demo
(10.7 T with
10 T from LTS)



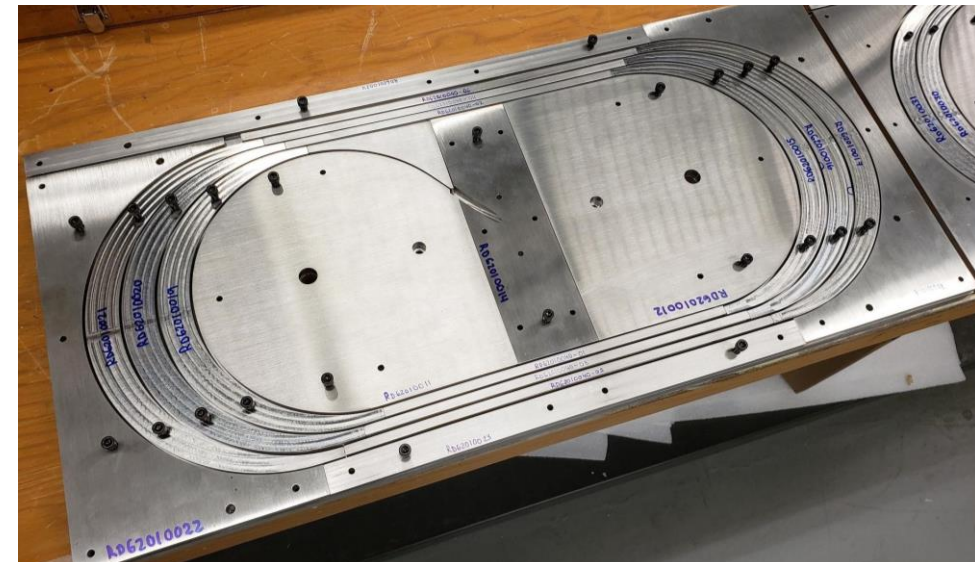
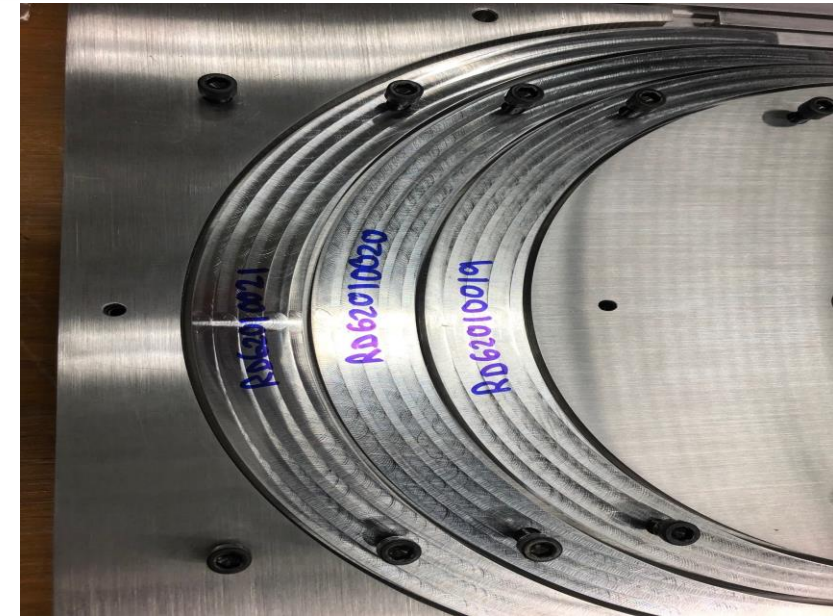
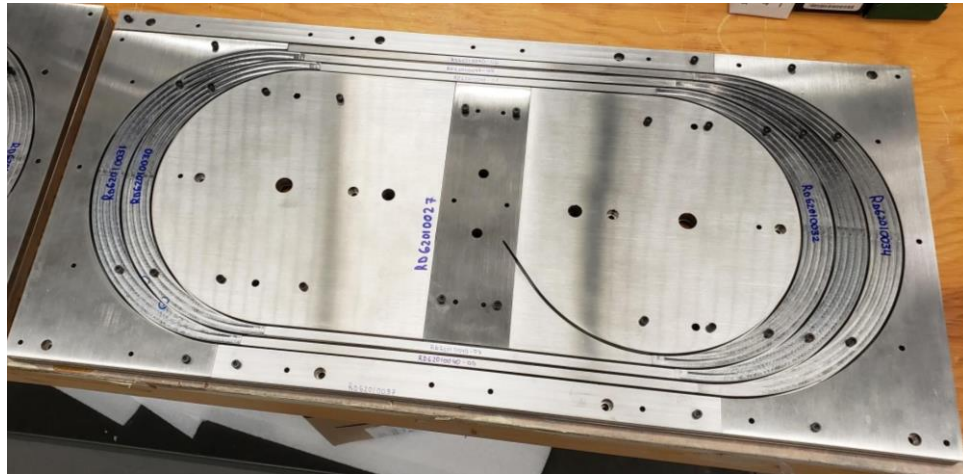
STTR:
High field Demo
(13-14 T with
10 T from LTS)

Status of MDP CORC Program (1)

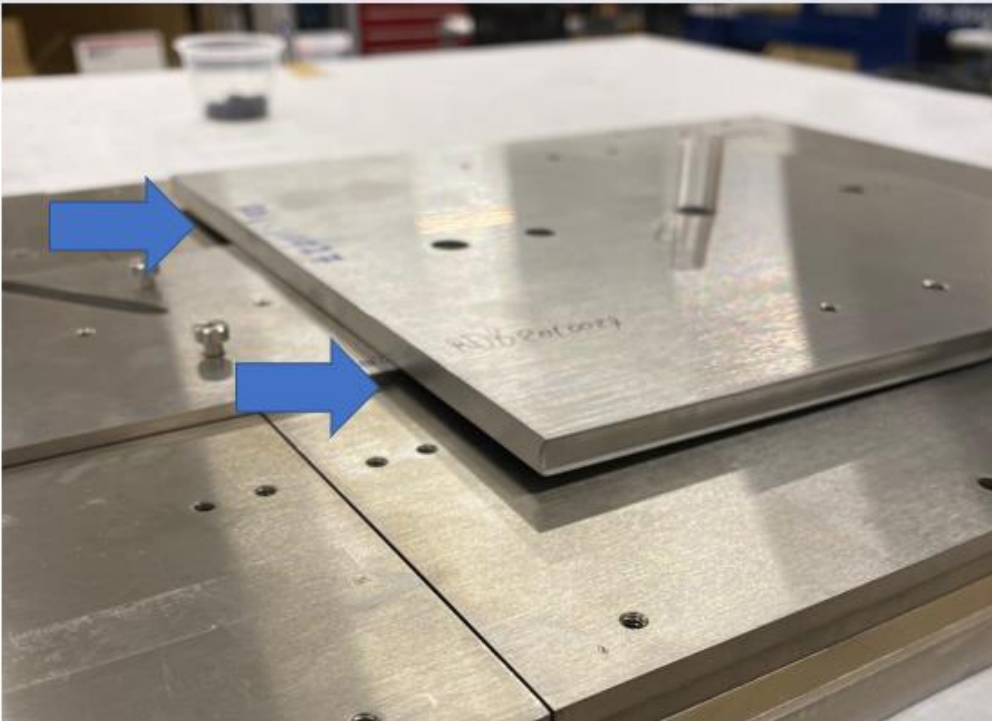


- Design work complete a while ago
- All parts obtained several months ago
- Parts were shipped from BNL to ACT for them
 - view them
 - make a practice cable
 - do initial winding test
 - Provide feedback
- ACT recommended tighter tolerances
- Some parts sent back to vendor
- Corrected parts received and sent to ACT
- New parts meet ACT expectations

A Few Coil Structure Parts



Status of MDP CORC Program (2)



- Regular discussion continues between BNL and ACT, and between BNL and MDP collaborators, and with all parties combined
- ACT will be doing initial test winding by hand in a couple of weeks
- ACT will send the practice cable and the coil parts back to BNL in about a month
- BNL will wind the practice coil on universal coil winder under tension.
- Details to be worked out (significant work)
- Real cable in a few months
- Test expected in six months after that

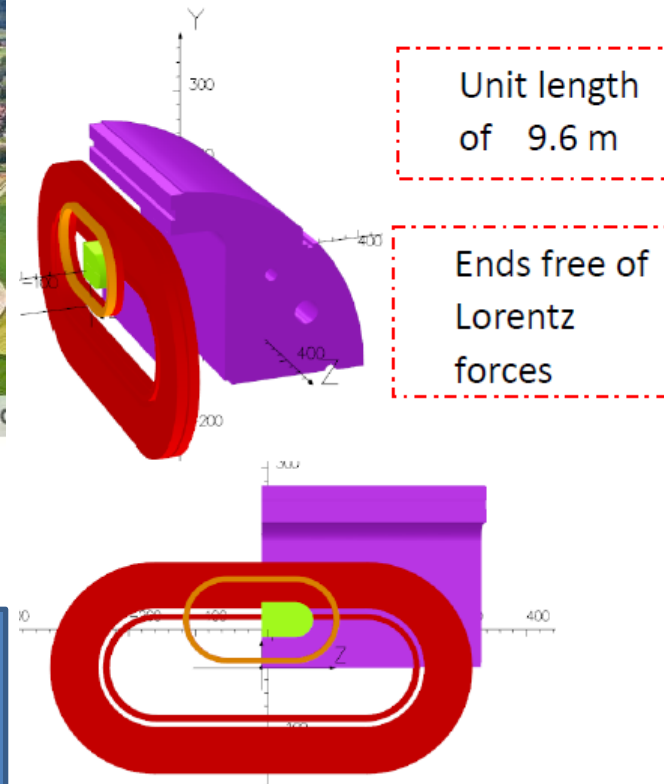


A Possible Opportunities to Continue HTS Scientific Studies without Scheduling a New Test

An Upcoming MDP Test (12/21)



Option 2



Douglas Martins Araujo, Michael Daly, Bernhard Auchmann

BigBOX

August 26, 2021

Only 1 of the 2 apertures of the common coil dipole is being used
(aperture is a terrible thing to waste)

Possible Opportunity in the 2nd Aperture

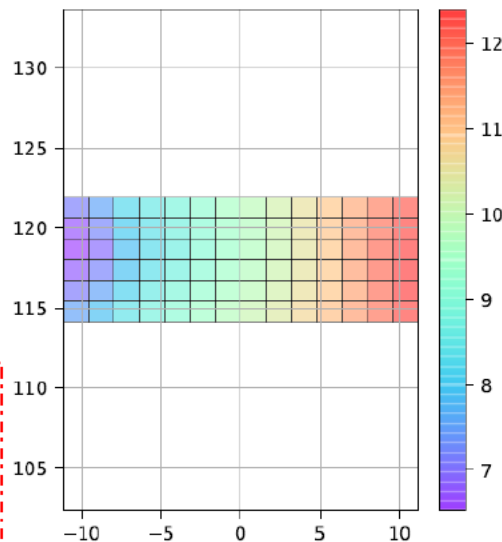
PAUL SCHERRER INSTITUT
PSI

Assessed parameters: margin vs stress

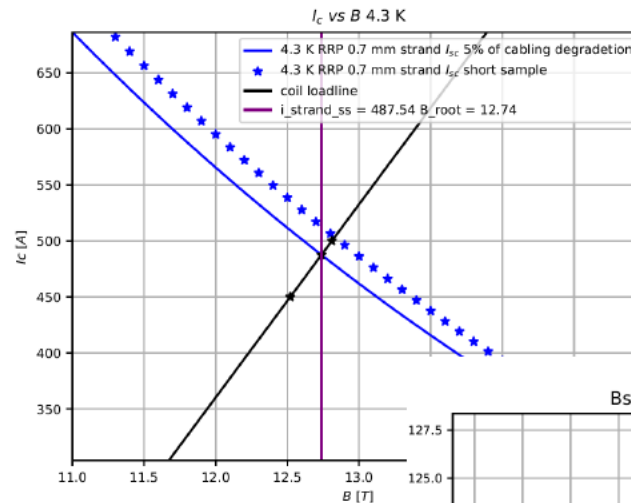
• 2D
Mechanical



• 3D
Magnetic



Field
computed
at element
center



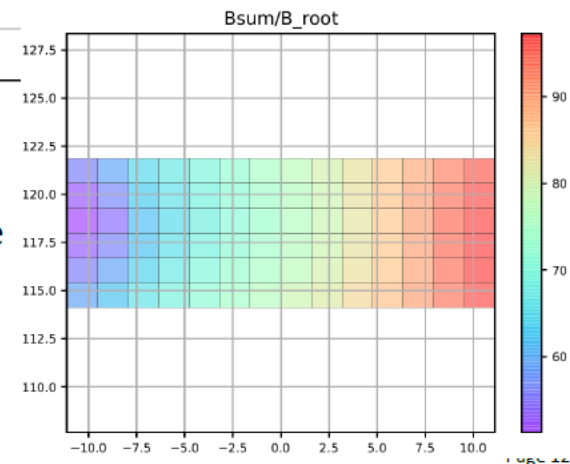
• Critical
curve and
load line

• Local
load line

Low field region
160 MPa / 7.0 T

High field region
80 MPa / 12.8 T

D. Martins Araujo



❑ During the last HTS/LTS hybrid test (Feb 2020), we didn't have a bipolar power supply. Therefore, we couldn't carry out complete hysteric cycle for the magnetization studies.

✓ Now, it is getting ready under US-Japan program

❑ Last time, the test was limited by LTS coil.

✓ Now, we have a better idea of how to overcome that

Why not explore this opportunity in one aperture to see if we can learn more

Summary and Discussion

- **Even though MDP test for “in-field quench studies of a long CORC cable” in the background field of common coil dipole is delayed by ~3 months, we continue to make good progress**
- **There is a good possible opportunity of carrying out useful experimental studies for HTS/LTS hybrid dipole**
 - **A personal opinion: Given the limited number of tests coming up every year in MDP and given the very limited knowledge of HTS/LTS coil interaction and of HTS magnetization, we should use all possible opportunity available, as long as there is a good scientific case**

Acknowledgement

This presentation benefited from the discussions with and direct contributions from the following colleagues:

ACT: Danko van der Laan, Jeremy Weiss

ASC: Ernesto Bosque, Lance Cooley

BNL: Anis Ben Yahia, Michael Anerella, Jesse Schmalzle, Piyush Joshi, ...

FNAL: Vadim Kashikhin, Vito Lomardo

LBNL: Xiaorong Wang, Maxim Martchevsky, Reed Teyber, Steve Gourlay

... and more

EXTRA SLIDES