

LBL RC7n8, the first 4.7 T Bi-2212 dipole magnet

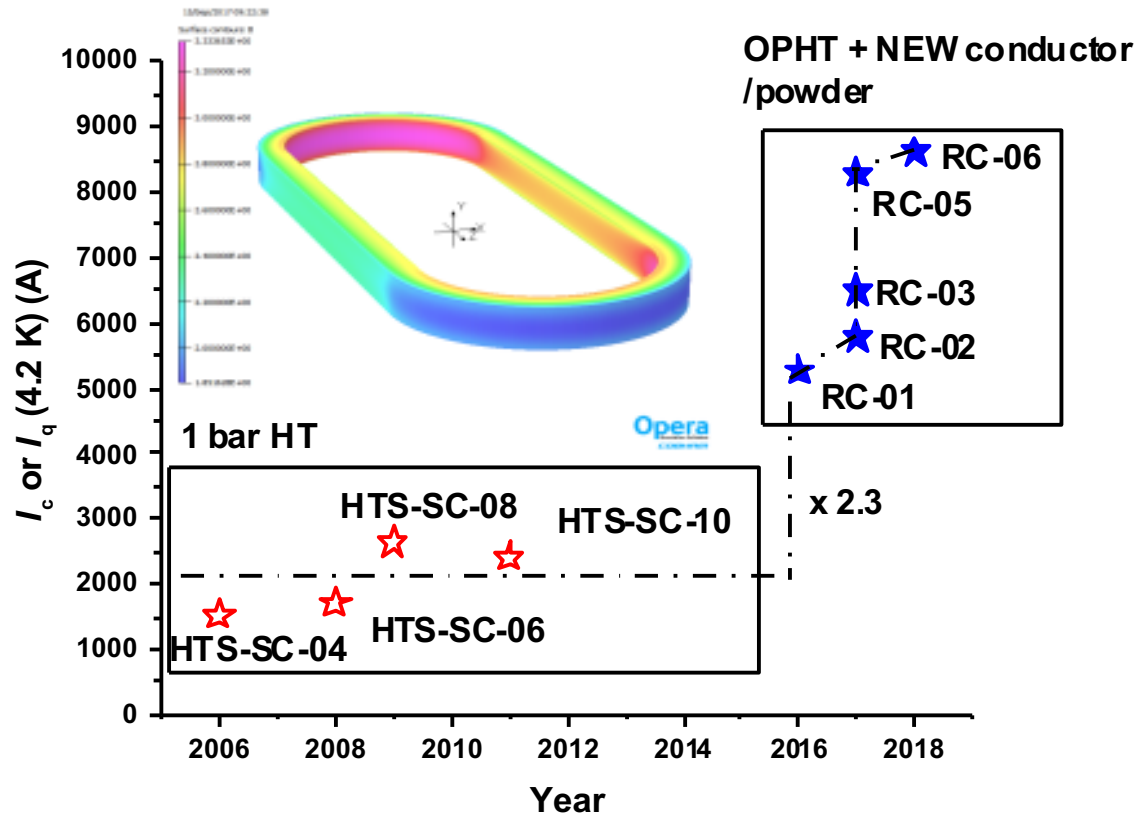
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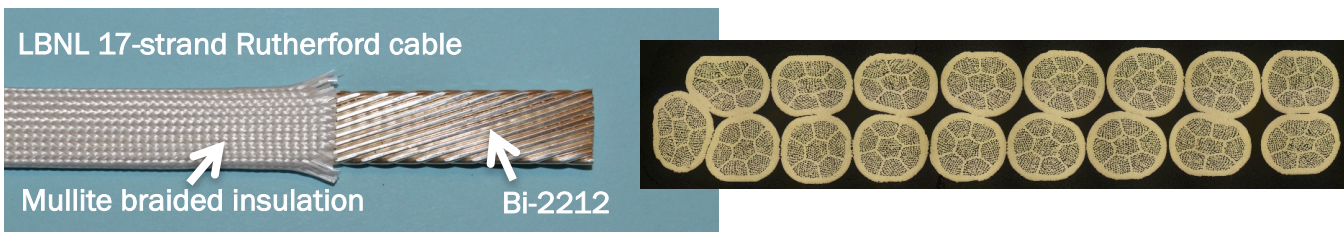
Sept 11, 2019

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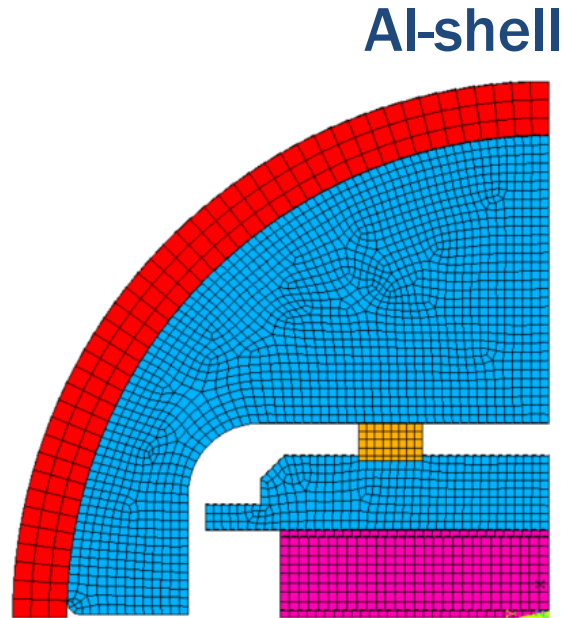
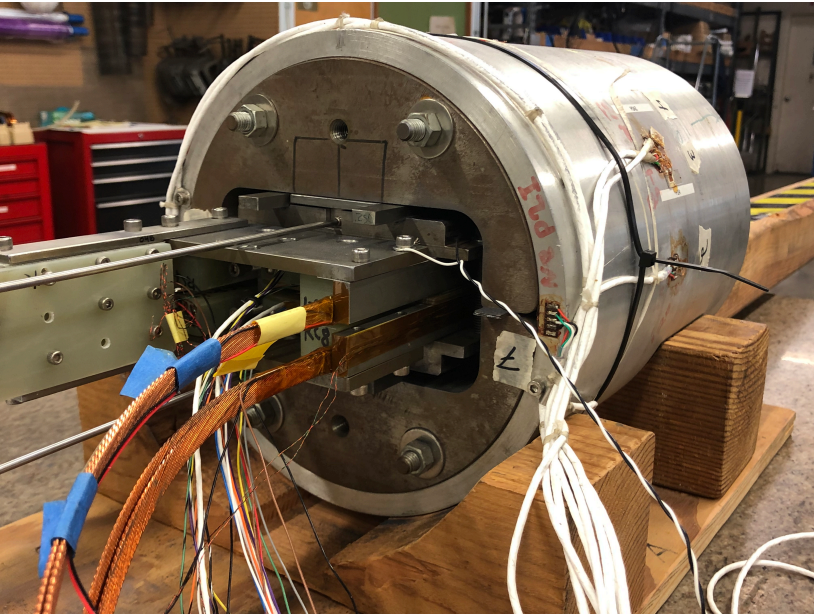
Moving beyond RC1-6: Towards using fully twisted, larger-billet wires and generating practical dipole field



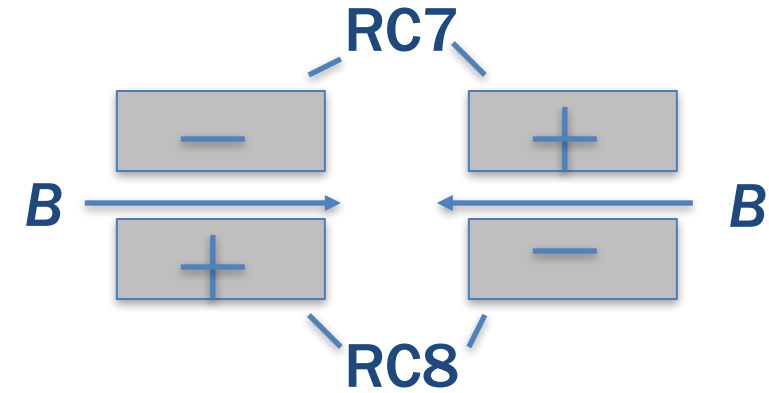
- RC1-6 (2-layer, 6-turn/layer, 17-strand Rutherford cable) made from non-twisted wire as degradation found in twisted wires in 2016.
 - Field with RC6 – 3.5 T.
- RC7 and RC8 made from twisted wires CDP-PMM180207 (10 kg billet, 2.4 km conductor, 0.8 mm, Engi-Mat powder)
 - No degradation due to twisting found in short strands (Bruker OST + J. Jiang FSU).
 - Larger coil winding (2-layer, 11-turn/layer, 17-strand Rutherford cable)



RC7 and RC8 were assembled using the LBNL bladder-and-key technology and powered as a common coil dipole



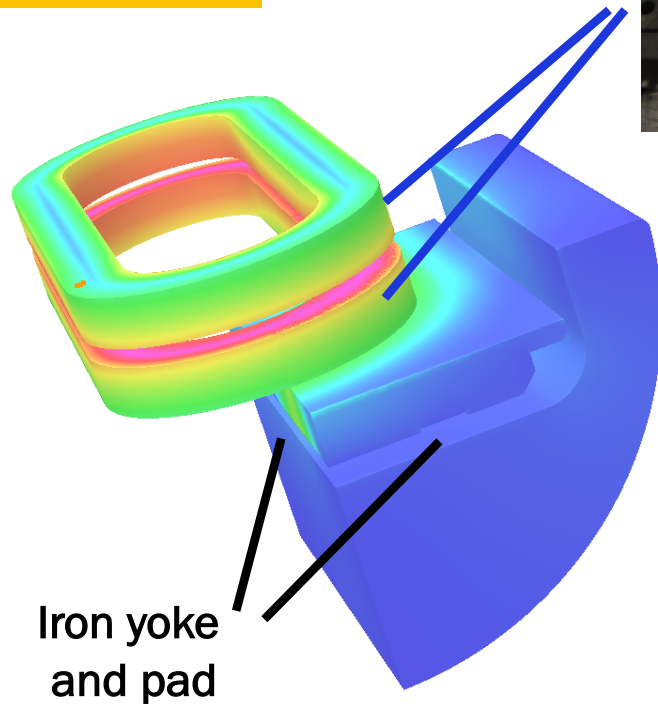
Iron yoke
Interference key
Pressure pad
Coil



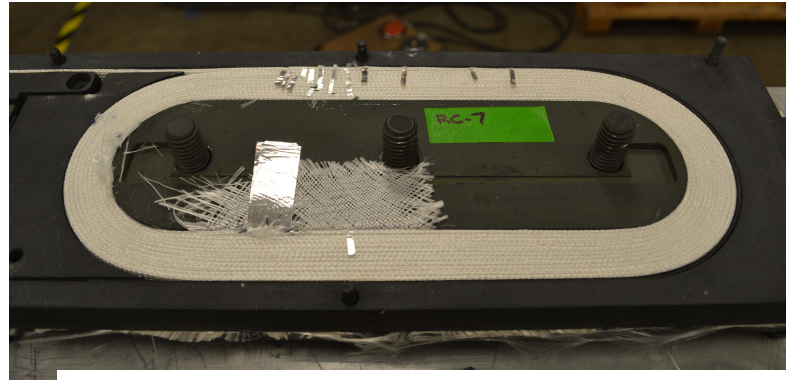
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- Two dipole field in one common-coil structure.
- Pole gap – 6 mm

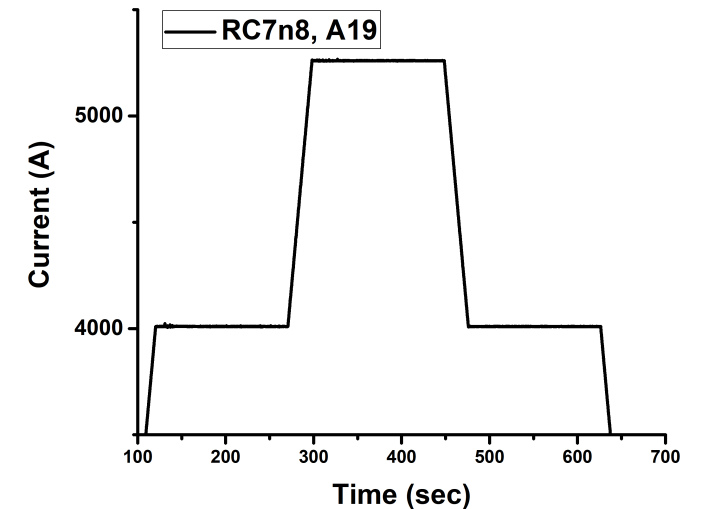
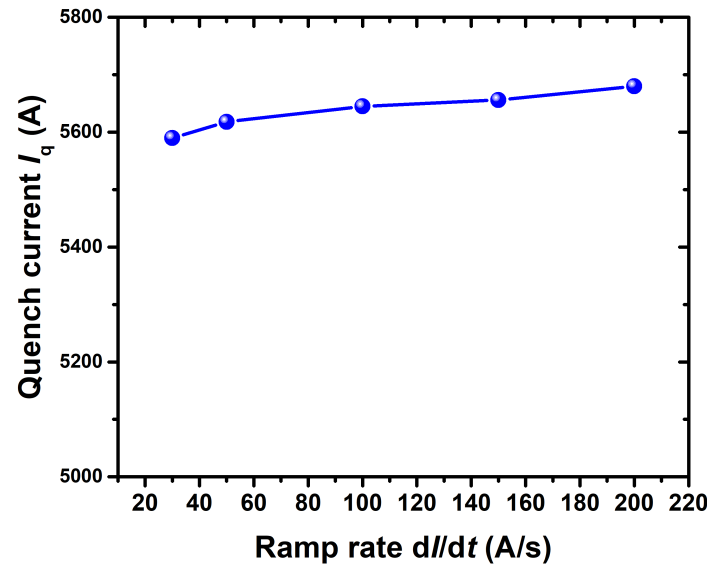
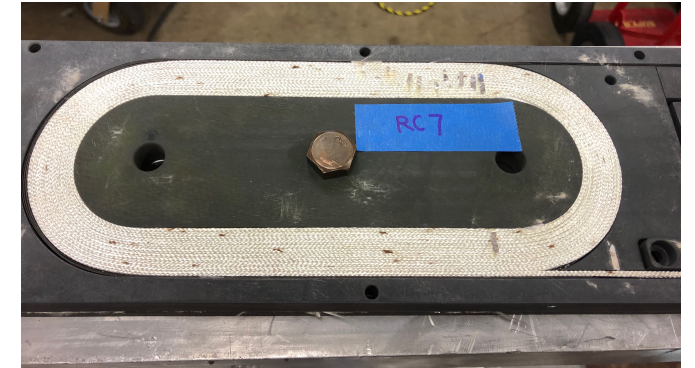
4.7 T, 5.7 kA.



RC 7 – Before reaction.

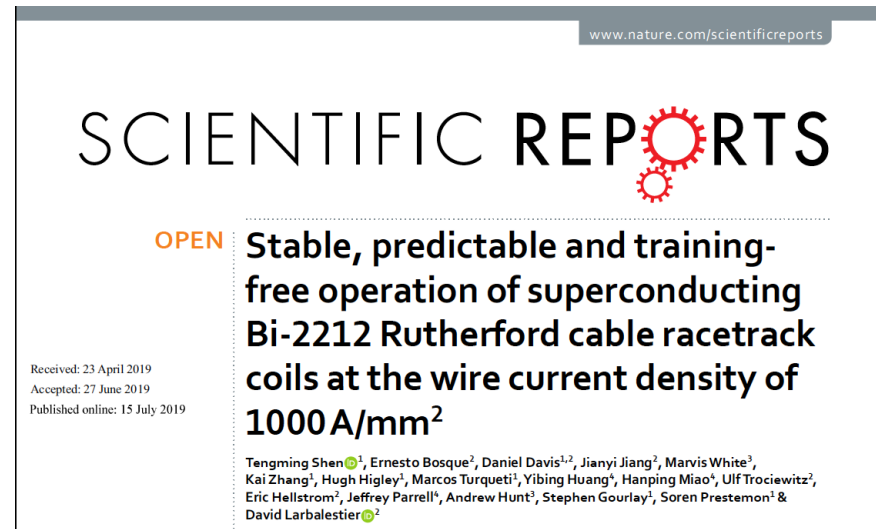
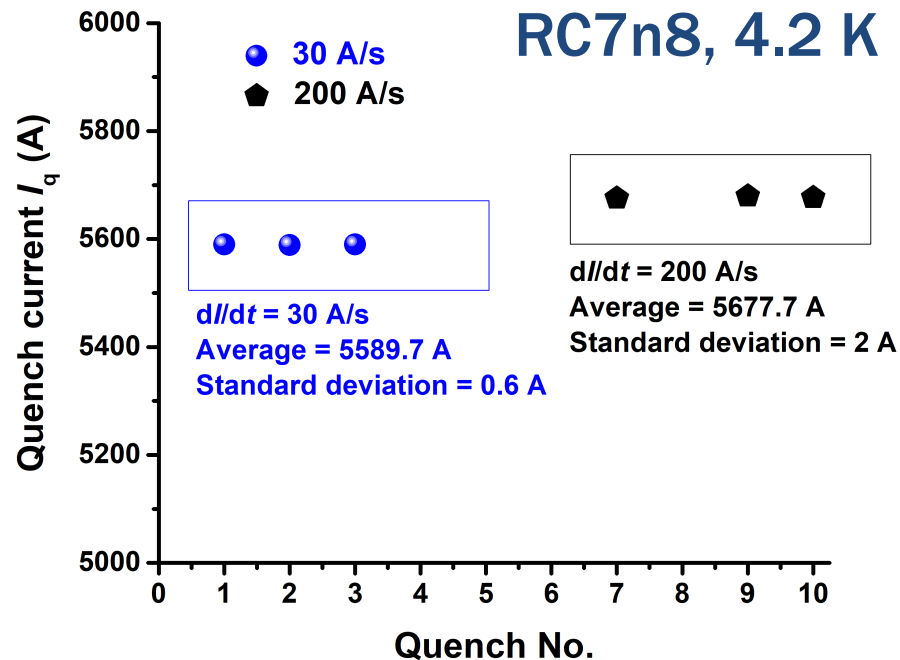


RC 7 – After reaction.



Stable, predictable, training-free operation found in RC1-6 verified in RC7n8

- No quench training.
- Thermal runaway quenches due to approaching conductor I_c .
- Different from LTS and REBCO, quenches are non-localized and their locations are predictable.
- Strong and clear signals measured by high-resolution voltage measurements indicating at what current quenches would occur, before any of thermal runaway quenches actually occur.



RC5-6 paper

Overall comments

- **The first 4.7 T Bi-2212 dipole.**
 - **A practical magnet suitable for particle beam bending with stable, predictable, quench training free behavior.**
 - **Complete the wire development cycle with a fully twisted, large industry Bi-2212 wire billet.**
 - **Wire J_e - ~ 670 A/mm² at 5 T and ~ 450 A/mm² at 20 T (extrapolated).**

- **Wire fabrication and characterization: Yibing Huang (Bruker OST), Aixia Xu (nGimat LLC), Jianyi Jiang (NHMFL)**
- **Cable fab: Ian Pong, Andy Lin, Hugh Higley.**
- **Coil fabrication: Hugh Higley, Tim Bogdanof, Tengming Shen**
- **Coil reaction: Ernesto Bosque (NHMFL) and Lamar English (NHMFL)**
- **Mechanical Assembly: Jim Swanson, Josh Herrera, Daniel Davis (NHMFL+LBNL), Tengming Shen**
- **Test: Marcos Tuerqueti, Jordan Taylor, Tim Bogdanof, Tengming Shen**
- **Magnetic and mechanical analysis: Laura Garcia Fajardo and Kai Zhang (now at PSI)**
- **Bladders used: Courtesy of Daniel Cheng**