



# 11TH MECHANICAL AND ELECTROMAGNETIC PROPERTIES OF COMPOSITE SUPERCONDUCTORS WORKSHOP

The Davenport Grand  
Spokane, Washington, USA  
June 10 – 14, 2024

## Monday, June 10

Attendees Arrival and Registration Check-in (16:00 - 19:00)

## Tuesday, June 11

| Talk ID#   | Time  | Minutes | Presenter<br>First & Last Name   | Presenter<br>Affiliation          | Presentation Title  | Abstract ID#       |  |
|--|-------|---------|--|-----------------------------------|---|--------------------|--|
|  | 8:00  | 15      | Najib Cheggour   | ASC-NHMFL-FSU, USA                | Opening Remarks   |                    |  |
| <b>Session 1: Nb<sub>3</sub>Sn, Nb<sub>3</sub>Al, and MgB<sub>2</sub> Conductors &amp; Cables — Updates and General Properties</b> |       |         |  |                                   |   |                    |  |
| Chairs: <b>TBD</b>   |       |         |  |                                   |   |                    |  |
| <b>TuM-01</b>  | 8:15  | 30      | <b>Simon C. Hopkins</b>  | CERN, Switzerland                 | Nb <sub>3</sub> Sn Wire performance and prospects for energy-frontier accelerator magnet applications   | <b>Invited</b> 019 |  |
| TuM-02   | 8:55  | 20      | GianMarco Bovone   | University of Geneva, Switzerland | Grain-boundary and oxide-nanoparticle contributions to the layer J <sub>c</sub> of internally oxidized Nb <sub>3</sub> Sn wires                       | 030                |  |
| <b>TUM-03</b>  | 9:25  | 30      | <b>Akihiro Kikuchi</b>   | NIMS, Japan                       | The Ultrafine superconducting wires and bundled cables  | <b>Invited</b> 014 |  |
|  | 10:05 | 10      | <b>COFFEE BREAK</b>  |                                   |   |                    |  |
| <b>Session 2: Nb<sub>3</sub>Sn and MgB<sub>2</sub> Conductors &amp; Cables — Electromechanical Properties</b>                      |       |         |  |                                   |   |                    |  |
| Chairs: <b>TBD</b>   |       |         |  |                                   |   |                    |  |
| TuM-04   | 10:15 | 20      | Najib Cheggour   | ASC-NHMFL-FSU, USA                | Surveying the irreversible strain limit and microstructure of multiple RRP <sup>®</sup> Nb <sub>3</sub> Sn wires in light of the δ-CuSn phase disease | 031                |  |
| TuM-05   | 10:45 | 20      | Mio Nakamoto   | KEK, Japan                        | Neutron diffraction measurements of transverse compression effects on Cu-Nb reinforcement for bronze route Nb <sub>3</sub> Sn wires                   | 038                |  |
| <b>TuM-06</b>  | 11:15 | 30      | <b>Carmine Senatore</b>  | University of Geneva, Switzerland | Stress tolerance and degradation mechanisms of accelerator-grade Nb <sub>3</sub> Sn wires under transverse compression                                | <b>Invited</b> 017 |  |
| TuM-07   | 11:55 | 20      | Shutaro Machiya  | Daido University, Japan           | Measurement of mechanical behavior of 11B enriched MgB <sub>2</sub> wire using pulsed neutron source  | 040                |  |
|  | 12:30 | 90      | <b>LUNCH (provided)</b>  |                                   |   |                    |  |
| <b>Session 3: Nb<sub>3</sub>Sn Cables and Magnets — Design &amp; Testing</b>   |       |         |  |                                   |   |                    |  |
| Chairs: <b>TBD</b>   |       |         |  |                                   |   |                    |  |
| <b>TuA-08</b>  | 14:00 | 30      | <b>Giorgio Vallone</b>   | LBL, USA                          | Assessing the impact of multi-axial loads on the performance of Nb <sub>3</sub> Sn coils for particle accelerator magnets                             | <b>Invited</b> 003 |  |
| <b>TuA-09</b>  | 14:40 | 30      | <b>Peter McIntyre</b>  | Texas A&M University, USA         | Structured cable-in-conduit for stress management in high-field dipoles   | <b>Invited</b> 009 |  |
| TuA-10   | 15:20 | 20      | Satoshi Awaji  | HFLSM, Tohoku University, Japan   | Electromechanical behaviors of CuNb/Nb <sub>3</sub> Sn Rutherford Cables and Coils for High Field Cryogen-free Superconducting Magnet                 | 026                |  |
|  | 15:50 | 15      | <b>COFFEE BREAK</b>  |                                   |   |                    |  |
| <b>TuA-11</b>  | 16:05 | 30      | <b>Alice Moros</b>   | CERN, Switzerland                 | Unveiling root causes of Nb <sub>3</sub> Sn coil performance limitations for a reliable fabrication of HL-LHC magnets                                 | <b>Invited</b> 007 |  |
| TuA-12   | 16:45 | 20      | Giorgio Ambrosio   | FNAL, USA                         | Lessons Learned from Fabrication and Test of 13 Nb <sub>3</sub> Sn Quadrupoles for the High Luminosity Large Hadron Collider                          | 004                |  |
| TuA-13   | 17:15 | 20      | Maria Baldini  | FNAL, USA                         | Development and test of a large-aperture Nb <sub>3</sub> Sn cos-theta dipole coil with stress management  | 045                |  |
| <b>Session 4: Nb<sub>3</sub>Sn — Linking Conductor Electro-Mechanical Properties to Magnet Performances</b>                        |       |         |  |                                   |   |                    |  |
| Chairs: <b>TBD</b>   |       |         |  |                                   |   |                    |  |
|  | 17:45 | 45      | <b>General Discussion on Nb<sub>3</sub>Sn Conductors &amp; Magnets</b> |                                   |   |                    |  |
|  | 18:30 |         | <b>END of DAY 1</b>  |                                   |   |                    |  |
|  |       |         | <b>DINNER (on your own)</b>  |                                   |   |                    |  |



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Wednesday, June 12

| Talk ID#  | Time          | Minutes   | Presenter<br>First & Last Name | Presenter<br>Affiliation                | Presentation Title  | Abstract ID# |  |
|---|---------------|---|--------------------------------|---|---|--------------|--|
|   | 8:00          | 10  | Najib Cheggour                 | ASC-NHMFL-FSU, USA                      | Opening Remarks   |              |  |
| <b>Session 5: Bi-2212 Conductors &amp; Cables — Electromechanical Properties</b>          |               |   |                                |   |   |              |  |
| Chairs: <b>TBD</b>  |               |   |                                |   |   |              |  |
| WeM-01  | 8:10          | 20  | Najib Cheggour                 | ASC-NHMFL-FSU, USA                      | Densification effects on critical-current dependence on longitudinal strain in Bi <sub>2</sub> Sr <sub>2</sub> CaCu <sub>2</sub> O <sub>8+x</sub> round wires | 029          |  |
| WeM-02  | 8:40          | 20  | Arend Nijhuis                  | University of Twente, The Netherlands   | Critical Current under transverse pressure in impregnated Bi-2212 Rutherford cables up to 200 MPa and 11 T at 4.2 K   | 044          |  |
| WeM-03  | 9:10          | 30  | Alex Otto                      | Solid Material Solutions, USA           | Bi2212 with reinforcement, electrical performance and loss to meet the requirements for specific coil applications  | Invited 032  |  |
|   | 9:50          | 20  | <b>COFFEE BREAK</b>            |   |   |              |  |
| <b>Session 6: Bi-2212 Magnets — Design &amp; Testing</b>                                  |               |   |                                |   |   |              |  |
| Chairs: <b>TBD</b>  |               |   |                                |   |   |              |  |
| WeM-04  | 10:10         | 20  | Emma Martin                    | ASC-NHMFL-FSU, USA                      | Investigating Reinforcement Methods for Bi-2212 Magnets   | 042          |  |
| WeM-05  | 10:40         | 20  | Meng-Liang Zhou                | Chinese Academy of Science, China       | The performance of first CICC-type Bi-2212 insert magnet under 20 T   | 012          |  |
| <b>Session 7: Bi-2223 Conductors, Cables &amp; Magnets — Electromechanical Properties</b> |               |   |                                |   |   |              |  |
| Chairs: <b>TBD</b>  |               |   |                                |   |   |              |  |
| WeM-06  | 11:10         | 20  | Gen Nishijima                  | NIMS, Japan                             | Superconducting magnet for magnetic refrigeration system  | 039          |  |
| WeM-07  | 11:40         | 20  | Ioseb R. Metskhvarishvili      | Georgian Technical University, Georgia  | Improvement of phase formation and critical current density in Bi-2223 HTS materials with the addition of Antimony trioxide                                   | 028          |  |
|   | 12:10         | 90  | <b>LUNCH (provided)</b>        |   |   |              |  |
| <b>Session 8: ReBCO Coated Conductors</b>   |               |   |                                |   |   |              |  |
| Chairs: <b>TBD</b>  |               |   |                                |   |   |              |  |
| WeA-08  | 13:40         | 30  | Bernardo Bordini               | CERN, Switzerland                       | The superconducting magnets of the Muon Collider – a study case for a future HEP machine  | Invited 043  |  |
| WeA-09  | 14:20         | 20  | Xiaodong Li                    | Technische Universität München, Germany | REBCO coated conductors for high-field fusion: state-of-the-art, challenges and perspectives  | 027          |  |
| WeA-10  | 14:50         | 20  | Jiamin Zhu                     | Shanghai Superconductor                 | The progress of the REBCO tapes in Shanghai Superconductor Technology Co. Ltd.  | 002          |  |
| WeA-11  | 15:20         | 20  | Maxim Marchevsky               | LBNL, USA                               | Defect mapping and quench propagation velocity measurements in HTS conductors using Hall array magnetometry   | 021          |  |
| WeA-12  | 15:50         | 20  | Alex Otto                      | Solid Material Solutions, USA           | Lamination reinforcement of HTS tapes to enable much broader and more cost-effective utilization in key applications  | 035          |  |
| WeA-13  | 16:20         | 20  | Zili Zhang                     | Chinese Academy of Science, China       | Exploration of the possible dominant factor on mechanical properties of the metallic substrate of commercial REBCO tape from different manufacturers          | 013          |  |
|   | 16:50         | 10  | <b>COFFEE BREAK</b>            |   |   |              |  |
|   | 17:00 - 19:00 | <b>EXCURSION: WALK to the SPOKANE FALLS — HUNTINGTON PARK &amp; SKYRIDE GONDOLA (RIDES VOLUNTARY) —</b> |                                |   |   |              |  |
|   |               | <b>MEM24 GROUP PHOTOGRAPH</b>   |                                |   |   |              |  |
|   | 19:00 - 22:00 | <b>MEM24 BANQUET at the DAVENPORT GRAND VENUE</b>   |                                |   |   |              |  |
|   | 22:00         | <b>END of DAY 2</b>   |                                |   |   |              |  |



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Thursday, June 13

| Talk ID#   | Time  | Minutes | Presenter<br>First & Last Name                                    | Presenter<br>Affiliation                      | Presentation Title   | Abstract ID# |  |
|--|-------|---------|---|---|--|--------------|--|
|  | 8:00  | 10      | Najib Cheggour  | ASC-NHMFL-FSU, USA                            | Opening Remarks  |              |  |
| <b>Session 9a: REBCO Coated Conductors— Electromechanical Properties</b>                     |       |         |   |   |  |              |  |
| Chairs: <b>TBD</b>   |       |         |   |   |  |              |  |
| ThM-01   | 8:10  | 20      | Iole Falorio  | SuperPower Inc., USA                          | Study of a novel hybrid slitting method for REBCO tapes and edge cracks propagation analysis   | 015          |  |
| ThM-02   | 8:40  | 30      | Hyung-Seop Shin   | Andong National University, South Korea       | Evaluation of the edge-Cu Layer effect on delamination strength for various Cu-Stabilized REBCO tapes using the anvil test method                            | Invited 022  |  |
| ThM-03   | 9:20  | 20      | Qi Yuan   | Wuhan National High Magnetic Field Center,    | Effects of DC fields and pulsed fields on the strain dependence of critical properties of REBCO  | 016          |  |
|  | 9:50  | 10      | <b>COFFEE BREAK</b>   |   |  |              |  |
| <b>Session 9b: REBCO Coated Conductors— Electromechanical Properties</b>                     |       |         |   |   |  |              |  |
| Chairs: <b>TBD</b>   |       |         |   |   |  |              |  |
| ThM-04   | 10:00 | 20      | Takanobu Kiss   | Kyushu University, Japan                      | Development of a continuous bending test setup for REBCO coated conductors applicable to a small bending diameter region less than 10 mm                     | 034          |  |
| ThM-05   | 10:30 | 20      | Kozo Osamura  | RIAS, Japan                                   | Bending Strain Dependence of Critical Current in HT- SC Wires  | 005          |  |
| ThM-06   | 11:00 | 20      | Rastislav Ries  | Institute of Electrical Engineering, Slovakia | Superconducting properties, bending limits and microstructure of the new-generation filamentized REBCO tapes intended for fusion magnets                     | 011          |  |
| ThM-07   | 11:30 | 20      | Tatsunori Okada   | HFLSM, Tohoku University, Japan               | In-plane domain control of REBCO coated conductors by bending strain and its effects on superconducting properties   | 041          |  |
| ThA-08   | 12:00 | 20      | Peifeng Gao   | Lanzhou University, China                     | Multi-dimensional electromechanical failure criterion for high-field REBCO magnets   | 037          |  |
|  | 12:30 | 90      | <b>LUNCH (provided)</b>   |   |  |              |  |
| <b>Session 10: REBCO Coated-Conductor Cables— Electromechanical Properties</b>               |       |         |   |   |  |              |  |
| Chairs: <b>TBD</b>   |       |         |   |   |  |              |  |
| ThA-09   | 14:00 | 30      | Venkat Selvamanickam  | University of Houston, USA                    | Electromechanical properties of REBCO tapes and wires  | Invited 020  |  |
| ThA-10   | 14:40 | 30      | Danko van der Laan  | Advanced Conductor Technologies, USA          | Development of the next generation of CORC® cables and wires with improved bending flexibility and in-field performance for high-field magnet applications   | Invited 033  |  |
| ThA-11   | 15:20 | 20      | Jeremy Weiss  | Advanced Conductor Technologies, USA          | Implications of current sharing in CORC® cables and CICC   | 024          |  |
|  | 15:50 | 15      | <b>COFFEE BREAK</b>   |   |  |              |  |
| ThA-12   | 16:05 | 20      | Arend Nijhuis   | University of Twente, The Netherlands         | Characterization of REBCO tapes and their performance in full-size REBCO CORC® 20 T class CICC for fusion; experiments and modeling                          | 001          |  |
| ThA-13   | 16:35 | 30      | Peter McIntyre  | Texas A&M University, USA                     | REBCO blocks-in-conduit: structured cable, stress management, transposition, and volumetric cooling for high-field insert windings for toroids and solenoids | Invited 010  |  |
| ThA-14   | 17:15 | 20      | Garfield Murphy   | ASC-NHMFL-FSU, USA                            | Methods for polishing and microscopy analysis of REBCO-coated conductors   | 046          |  |
| <b>Session 11: REBCO Coated-Conductors &amp; Cables — Their Robustness &amp; Limitations</b> |       |         |   |   |  |              |  |
| Chairs: <b>TBD</b>   |       |         |   |   |  |              |  |
|  | 17:45 | 45      | <b>General Discussion on REBCO Coated-Conductors &amp; Cables</b> |   |  |              |  |
|  | 18:30 |         | <b>END of DAY 3</b>   |   |  |              |  |
|  |       |         | <b>DINNER (on your own)</b>                                       |   |  |              |  |



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Friday, June 14

| Talk ID# | Time | Minutes | Presenter<br>First & Last Name | Presenter<br>Affiliation | Presentation Title | Abstract ID# |
|----------|------|---------|--------------------------------|--------------------------|--------------------|--------------|
|          | 8:00 | 10      | Najib Cheggour                 | ASC-NHMFL-FSU, USA       | Opening Remarks    |              |

Session 12: ReBCO Coated-Conductor Magnets

Chairs: TBD

|        |      |    |                  |                                   |   |             |
|--------|------|----|------------------|-----------------------------------|---|-------------|
| FrM-01 | 8:10 | 30 | Satoshi Awaji    | HFLSM, Tohoku University, Japan   | Mechanical design of HTS coils for 33T cryogen-free superconducting magnet  | Invited 025 |
| FrM-02 | 8:50 | 20 | Rui Diaz-Pacheco | Commonwealth Fusion Systems, USA  | Electromechanical properties of SPARC CS and PF superconductor cables under relevant transverse and axial compression   | 008         |
| FrM-03 | 9:20 | 20 | Yunfei Gao       | Kyoto University, Japan           | Development of mechanically and electrically robust stator winding for fully high-temperature superconducting generator | 036         |
| FrM-04 | 9:50 | 20 | Shixian Liu      | Chinese Academy of Science, China | Electromechanical-thermal analysis of a no-insulation REBCO racetrack coil considering non-uniform stress distribution  | 023         |

10:20 20

COFFEE BREAK

Session 13: ReBCO Coated Conductors — Linking Conductor Electro-Mechanical Properties to Magnet Performances

Chairs: TBD

10:40 40

General Discussion on ReBCO Coated Conductors & Magnets

Session 14: Electromechanical Benchmarking and Standardization

Chairs: TBD

|        |       |    |                     |                       |   |             |
|--------|-------|----|---------------------|-----------------------|---|-------------|
| FrM-05 | 11:20 | 30 | Kozo Osamura        | RIAS, Japan           | Standardization of test methods for SC wire in IEC TC90                                   | Invited 006 |
| FrA-06 | 12:00 | 20 | Damian P. Hampshire | Durham University, UK | Large scale verification of Nb <sub>3</sub> Sn and Nb-Ti superconducting strands for ITER | 018         |

12:30 30

LUNCH (provided boxed lunch)

Session 15: Electromechanical Metrology and Standardization

Chairs: TBD

13:00 30

General Discussion on Electromechanical Metrology & Standardization Needs

13:30

CLOSING

15:00 - 20:00

POSSIBLE EXCURSION — CRUISE ON LAKE COEUR D'ALENE (IDAHO) — NOT CERTAIN YET —  
 DETAILS BEING WORKED ON