

# Task 5: High-Tc superconducting link

## Summary of work-package

**Amalia Ballarino** (CERN)

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# Work-package description



Use of HTS technology in superconducting long-distance quasi-dc buses providing the electrical link between power converters and superconducting magnet systems and/or between cold magnets.

Advantage with respect to existing Nb-Ti buses:

- gain in temperature margin, with more relaxed requirements for the cryogenic system;
- capacity of absorbing additional transient heat loads (e.g. due to radiation losses);
- simplified cold-powering system, with possibility of removing the cryogenic feedboxes and related equipment (current leads, control valves, level gauges,...) to a radiation free area.

Such an HTS multiple circuits He gas-cooled bus, electrically insulated at 1 kV-2 kV and carrying quasi dc currents, does NOT exist yet.

# Participants



- CERN (A. Ballarino)
- Columbus (S. Berta, G. Grasso)
- DESY (W. Zeuner)
- BHTS (A. Aubele, B. Sailer)
- University of Southampton (Y. Yang)

# Work-package Sub-Tasks



**Sub-Task 1:** Development and characterization of conductors suitable for application to He gas cooled HTS links.

Conductors analyzed: **MgB<sub>2</sub>**, **Bi-2212**, **Bi-2223**, and **YBCO** 2<sup>nd</sup> generation material.

Temperature range of operation: between 4.2 K and 77 K.

Electrical and mechanical properties;

How to characterize long lengths at temperatures below 50 K ?

**Goal:** qualification of conductors on the basis of electrical, thermal and mechanical properties as needed for application to a superconducting bus-system. Selection of the most promising conductors.

**Deliverable:** material properties and characterization processes.

# Work-package Sub-Tasks



**Sub-Task 2:** Design and test of electrical contacts.

**Goal:** Qualification of electrical joints for interconnection in a superconducting magnet system (HTS/HTS, HTS/Cu, HTS/LTS).

**Deliverable:** Procedures for making low-resistance joints.

# Work-package Sub-Tasks



**Sub-Task 3:** Design of a long-length HTS multi-circuit bus.

Development of electrical insulation of architecture suitable for a quasi-dc 1 kV range HTS cable operating in He gas.

Study of stability and quench propagation in HTS conductor, and study of quench protection of HTS bus.

**Goal:** Design of a multi-conductors link of the type needed for application to accelerators (e.g. 26 circuits 600 A).

**Deliverable:** Short length (few meters) of cable assembly.

# Global plan



It needs to be discussed among participants. In particular, spending profiles, and activities and responsibilities of participants will be agreed between now and 1<sup>st</sup> of April 2009.

Proposed plan and activities distribution:

- Starting date: 1<sup>st</sup> September 2009.
- Sub-task 1 and sub-task 2 (conductors qualification and selection, joints qualification) : 2009-2011.
- Sub-task 3 (stability and quench protection, cable assembly): 2011-2013.

A detailed plan will be ready by September 2009.