

4LP4-07

High Current REBCO-CORC Bus Bars for Large Detector Magnets

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Motivation

Maintenance and operation of the cryogenic plant and the power converter is more practical on the surface.

Current leads go from the surface 400 meter down to the detector magnet. Bus bars based on the CORC CICC conductor are lighter and take less space.

Detector magnets need to be moved during maintenance. Flexible bus bars prevent disassembly and assembly of these bus bars during each maintenance run.

400 m

Detector Cavern

In the case of power/refrigerator failure, cold liquid can be stored in the side cavern to cool the CORC bus bars during magnet ramp down.

Several variants of detector magnets are investigated. The stored energy of these magnet systems ranges from 13.8 to 68 GJ, with currents between 30 and 80 kA.

Recent Detector Magnet System Designs:
2016 – 6T/12m_bore Twin Solenoid – 80 kA & 68 GJ
2017 – 4T/10m_bore Main + Forward Solenoids – 30 kA & 14 GJ

	ATLAS Bus Bars	Future Normal Bus Bars	Future SC Bus Bars
Current (kA)	20	80	80
Material	Aluminium	Aluminium	REBCO CORC
Length (m)	300	1000	1000
Cross-section (cm ²)	400	1600	200
J _{stabilizer} (A/mm ²)	0.5	0.5	10
Mass (kg)	33.000	430.000	80.000
Voltage @ Operation (V)	8	28	-
Power @ Operation (kW)	160	2240	-

- Requirements
- The bus bars need to carry 80 kA at 50 K and 1 T.
 - Bus bars are cooled by the return gas of the magnet’s liquefier.
 - Bus bars require flexibility for opening and closing of the magnet system.
 - Survive quench in the detector magnets.
 - Survive quench in bus bar itself.
 - Survive cooling failure.

- Conclusion
- ✓ CORC Six-Around-One Bus Bar is in development.
 - ✓ Bus bar can be scaled up to 100 kA depending on detector magnet size.
 - ✓ CORC bus bar greatly reduces power converter requirements.
 - ✓ CORC bus bar reduces weight of the bus bars.
 - ✓ Bus bars are protected by the fast-dump resistor of the magnet system.

