# High Current REBCO-CORC Bus Bars for Large Detector Magnets

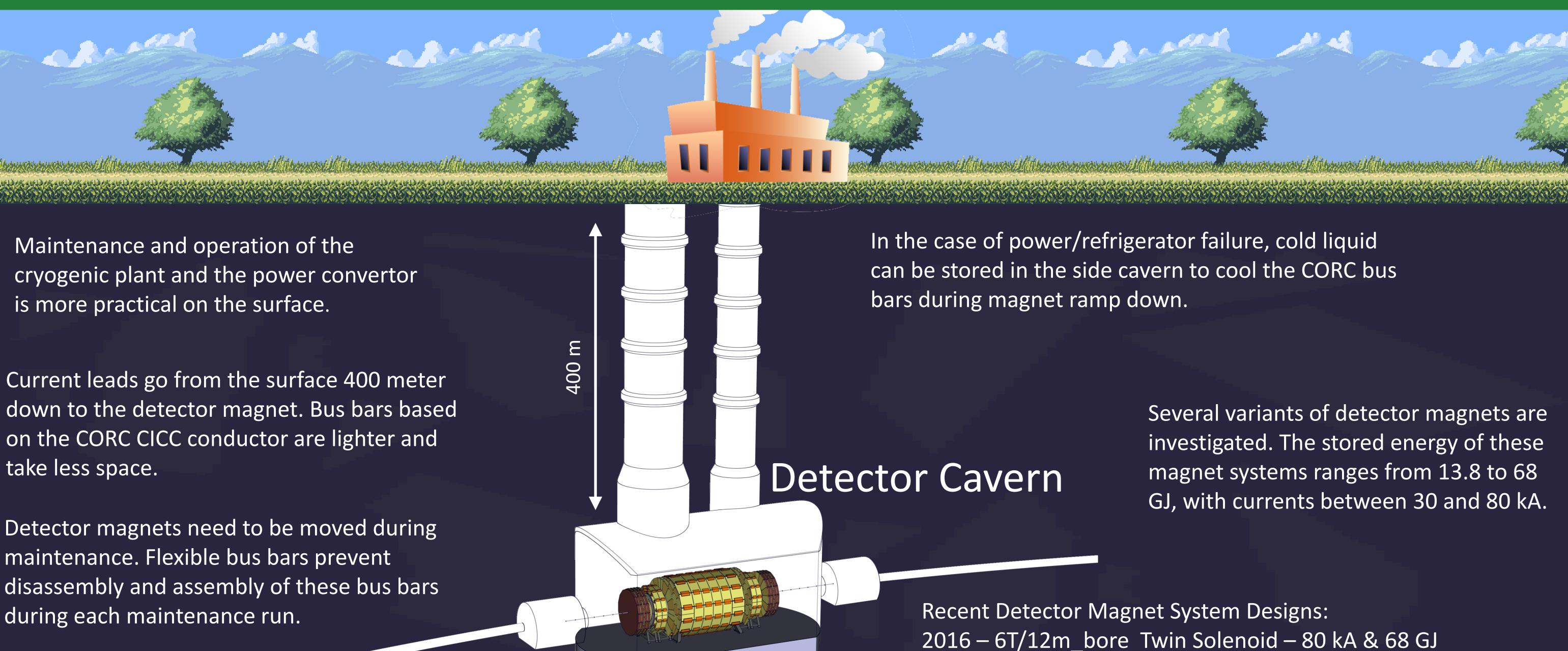
#### T. Mulder<sup>1,2</sup>, A. Dudarev<sup>1</sup>, H. Silva<sup>1</sup>, M. Dhalle<sup>2</sup> and H.H.J. ten Kate<sup>1</sup>

- 1. CERN, Genève, Switzerland
- 2. University of Twente, Enschede, the Netherlands

# UNIVERSITY OF TWENTE.



### Motivation



## **CORC CICC Bus Bar Design**

	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 <sup>2</sup> )	400	1600	200
J <sub>stabilizer</sub> (A/mm <sup>2</sup> )	0.5	0.5	10
Mass (kg)	33.000	430.000	80.000
Voltage @ Operation (V)	8	<u>28</u>	<del>-</del>
Power @ Operation (kW)	160	2240	_

#### 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.

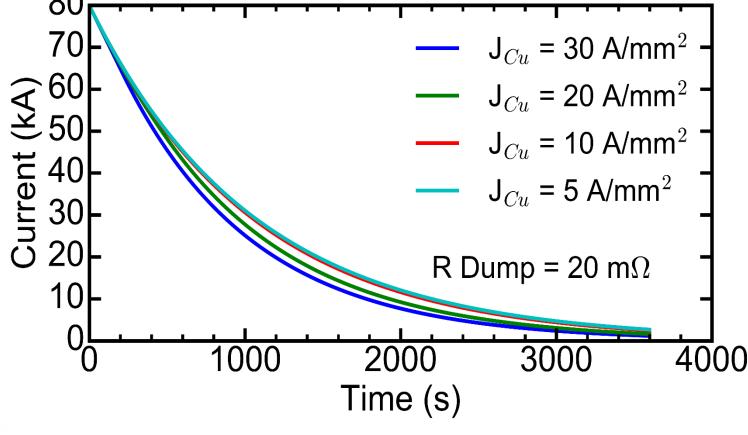
# Requirements

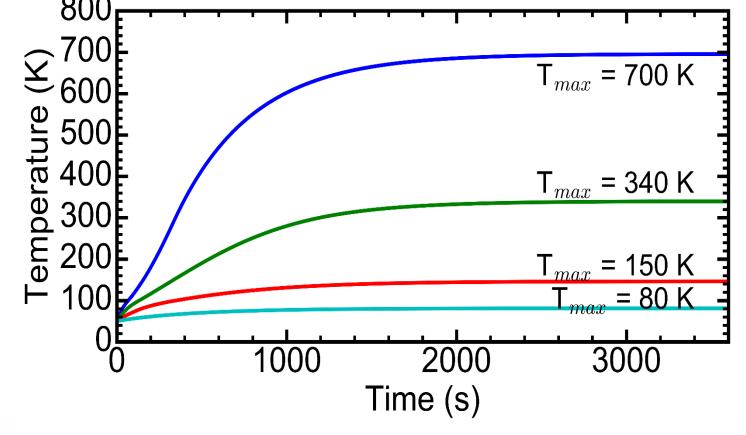
2017 – 4T/10m\_bore Main + Forward Solenoids – 30 kA & 14 GJ

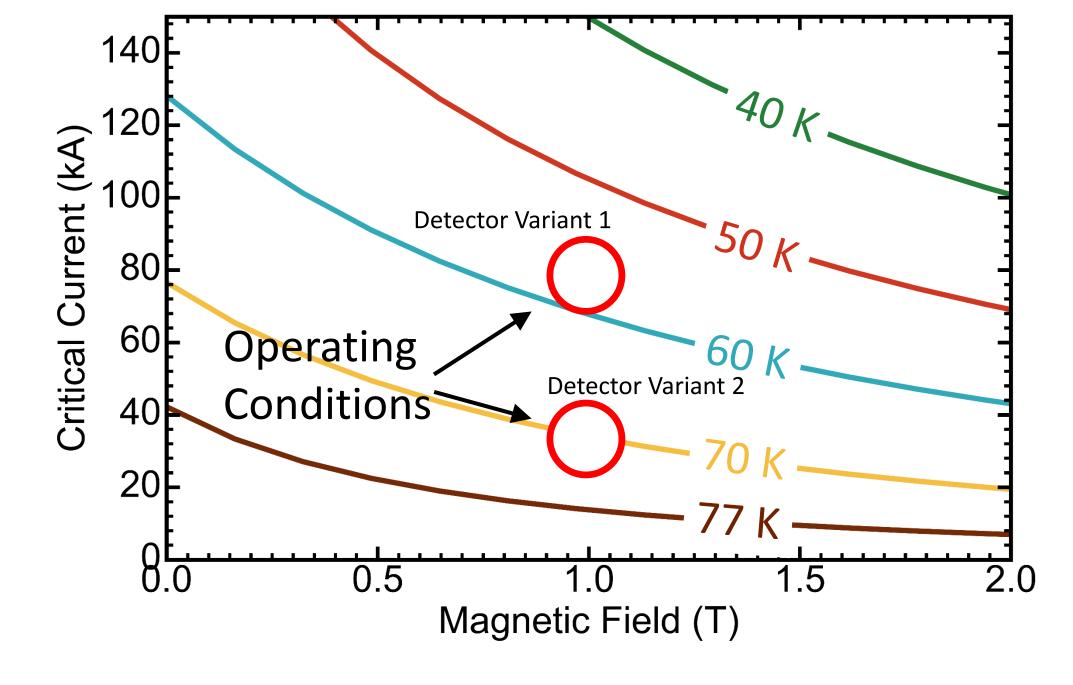
- The bus bars need to carry 80 kA at 50 K and 1 T.
- Bus bars are cooled by the return gas of the magnet's liquefier.
- Bus bars require flexibility for opening and closing of the magnet system.
- Survive quench in the detector magnets.
- Survive quench in bus bar itself.
- Survive cooling failure.

## **Thermal Stability**

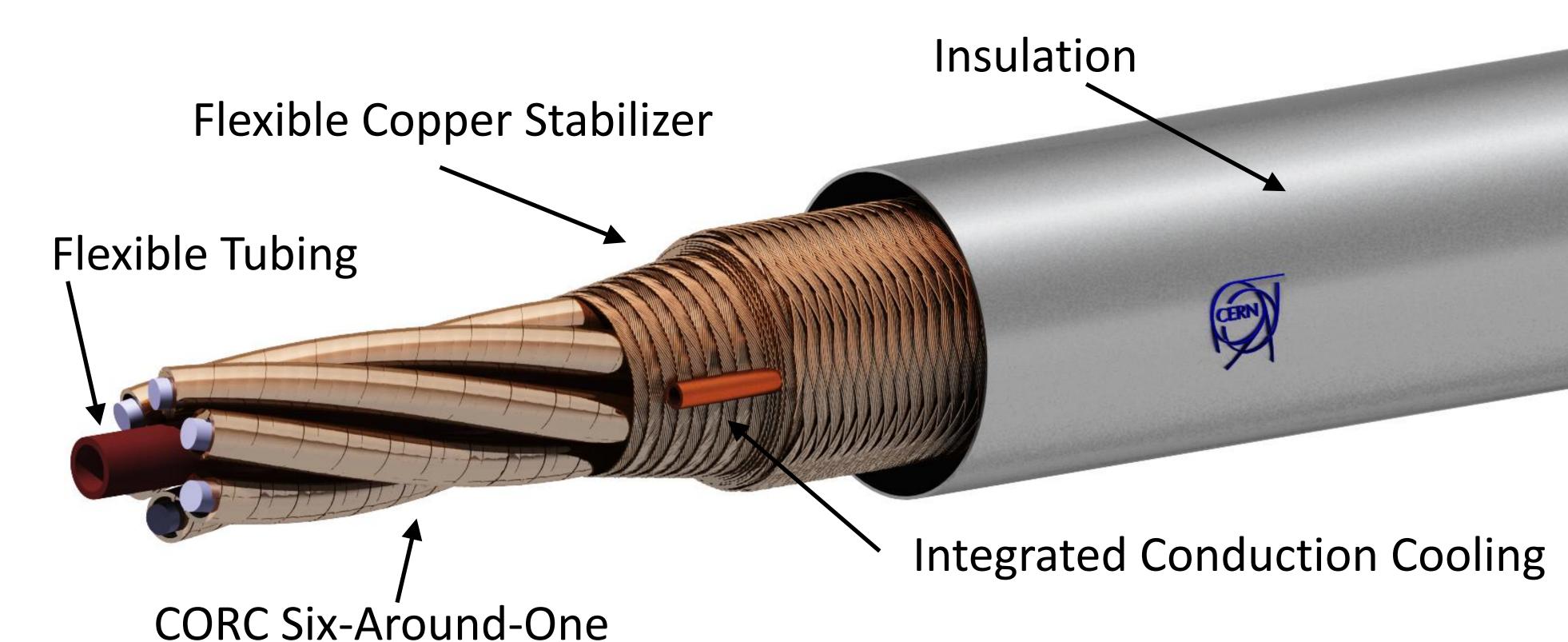
- Hot spot temperature in bus bar in case of a quench in the 80 kA Twin Solenoid magnet is about  $\underline{150-300~K}$ , the fast-dump is initiated and the bus bars are heated without heating the magnet (R\_Dump =  $20~m\Omega$  -> 1600~V).
- The 30 kA / 14 GJ detector magnet allows less copper stabilizer or a lower dump resistor to achieve the same hot spot temperatures.







Expected performance of the CORC Six-Around-One Bus bar



Presented at EUCAS 2017, Geneva, Switzerland, 21 September 2017