

# Design Aspects of REBCO-CORC Cable-In-Conduit Conductors

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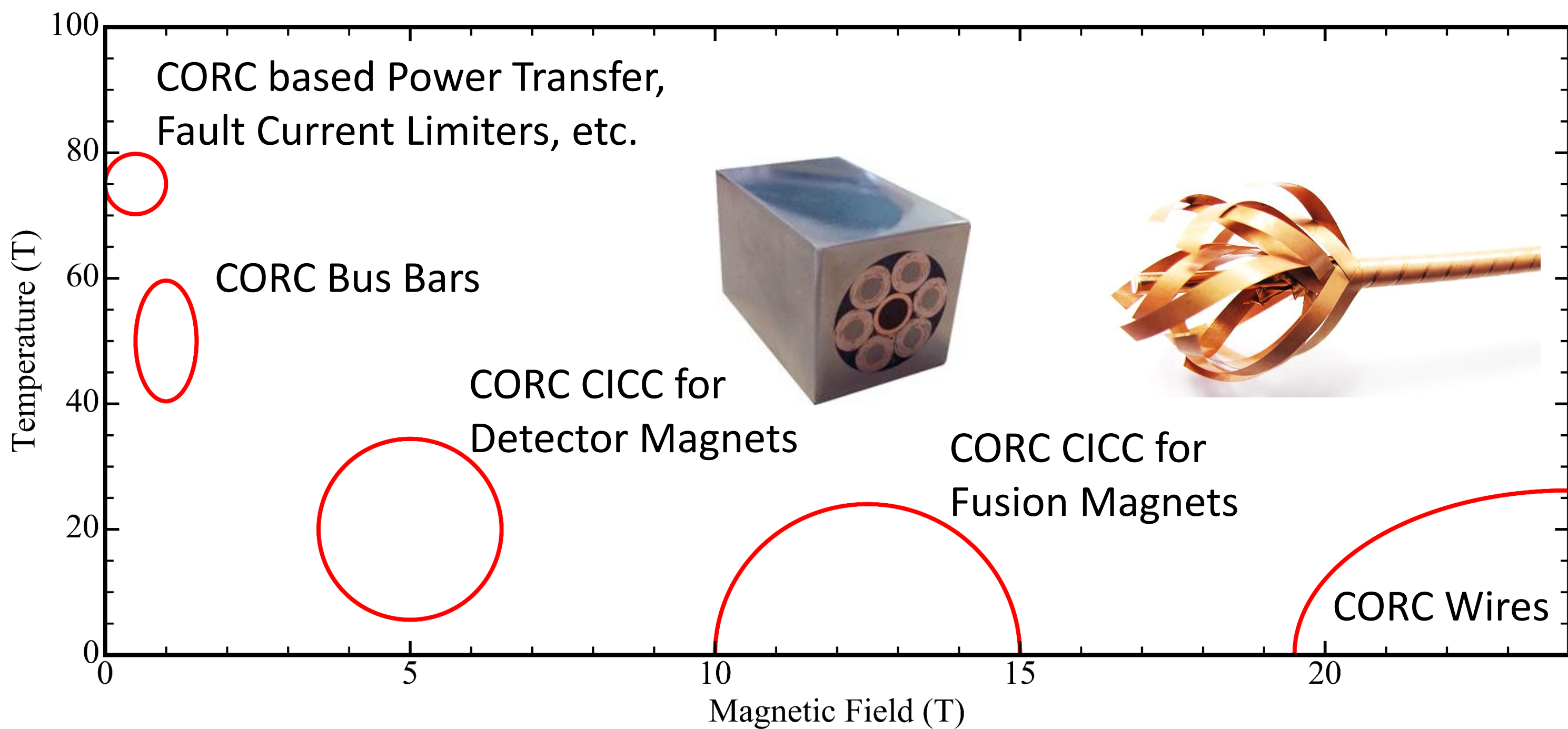


## Introduction

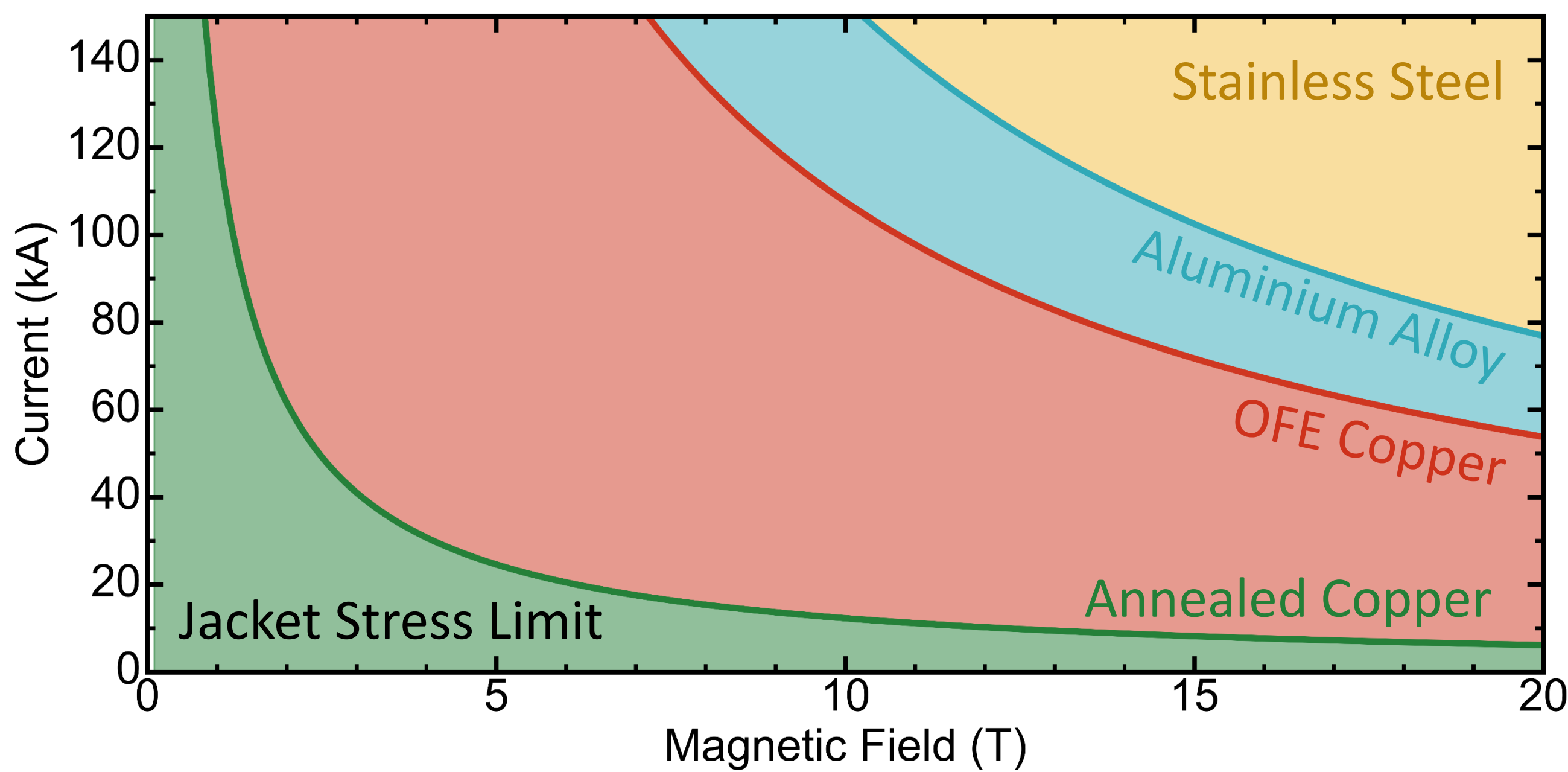
Various types of ReBCO based conductors are now in development for use in magnet systems, power transmission cables and smaller applications.

The CORC Cable-In-Conduit Conductor (CICC) is designed for high current magnets and their bus bars. Large magnets for particle detectors have different requirements than magnet systems for fusion.

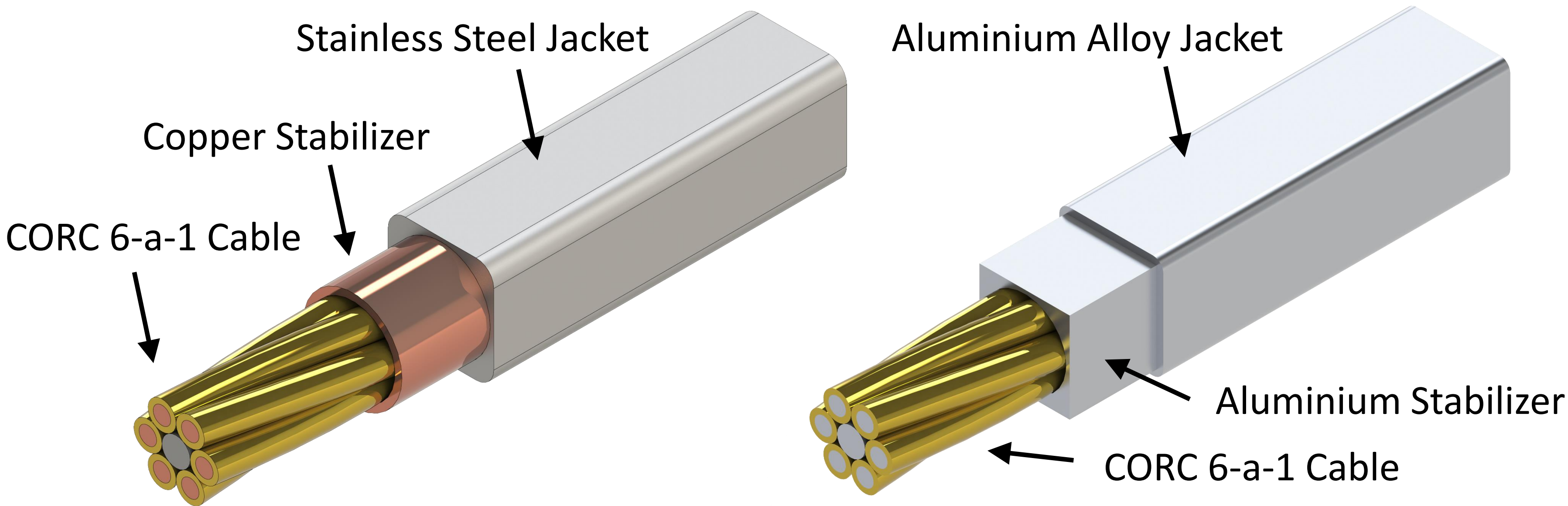
Two different CORC CICC designs are presented here. One is designed for magnet systems for a fusion reactor and the second is designed for detector magnets.



## REBCO CORC Cable-In-Conduit Conductors



Stress limit for a single CORC CICC. The conductor in a multi-layer magnet experience larger stresses and therefore likely require an aluminum alloy or stainless steel jacket.



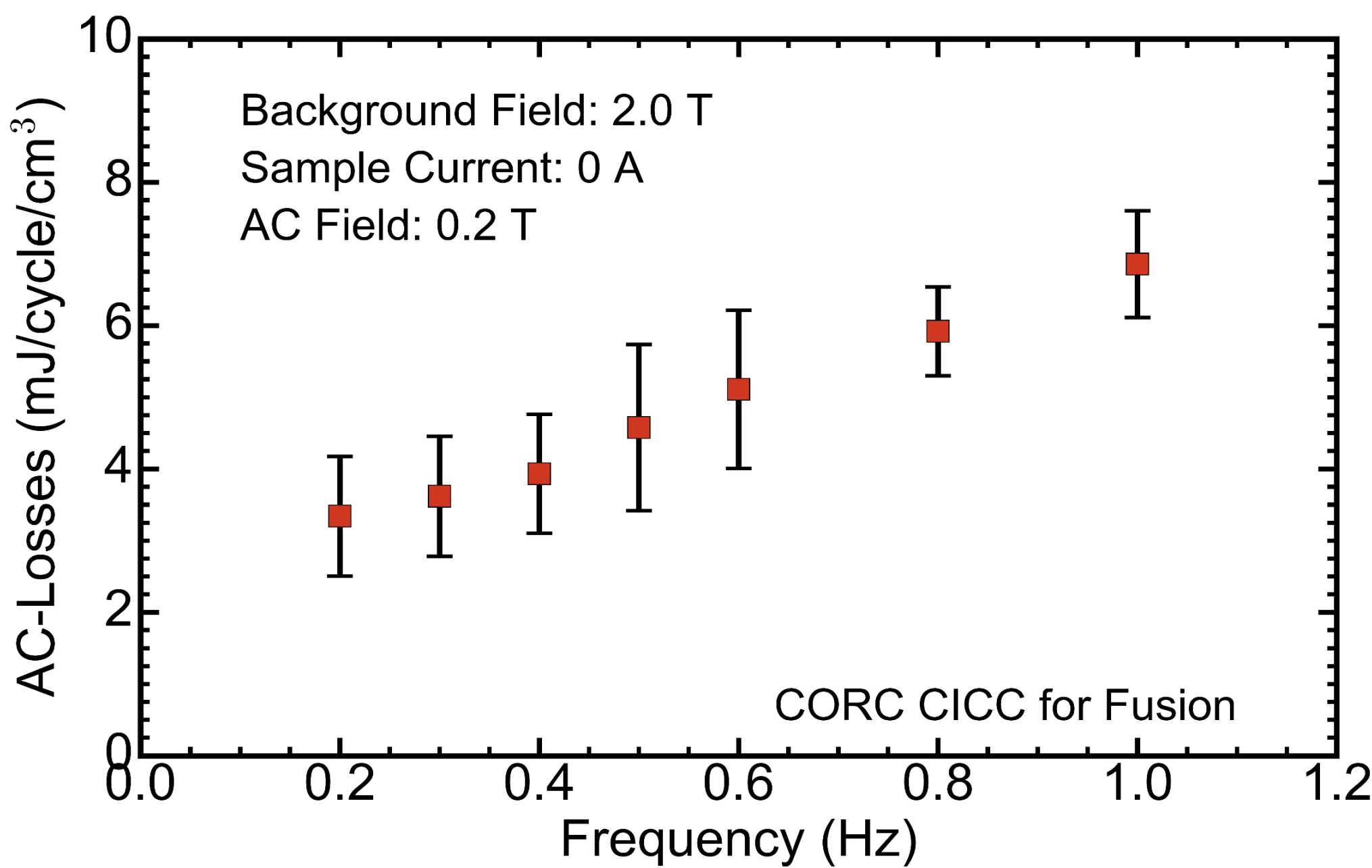
### CORC CICC for Fusion Magnets:

- Stainless steel jacket (stresses)
- Minimal copper for low AC-losses
- Internal Forced-Flow cooling
- Operation at 5 K and 12 T

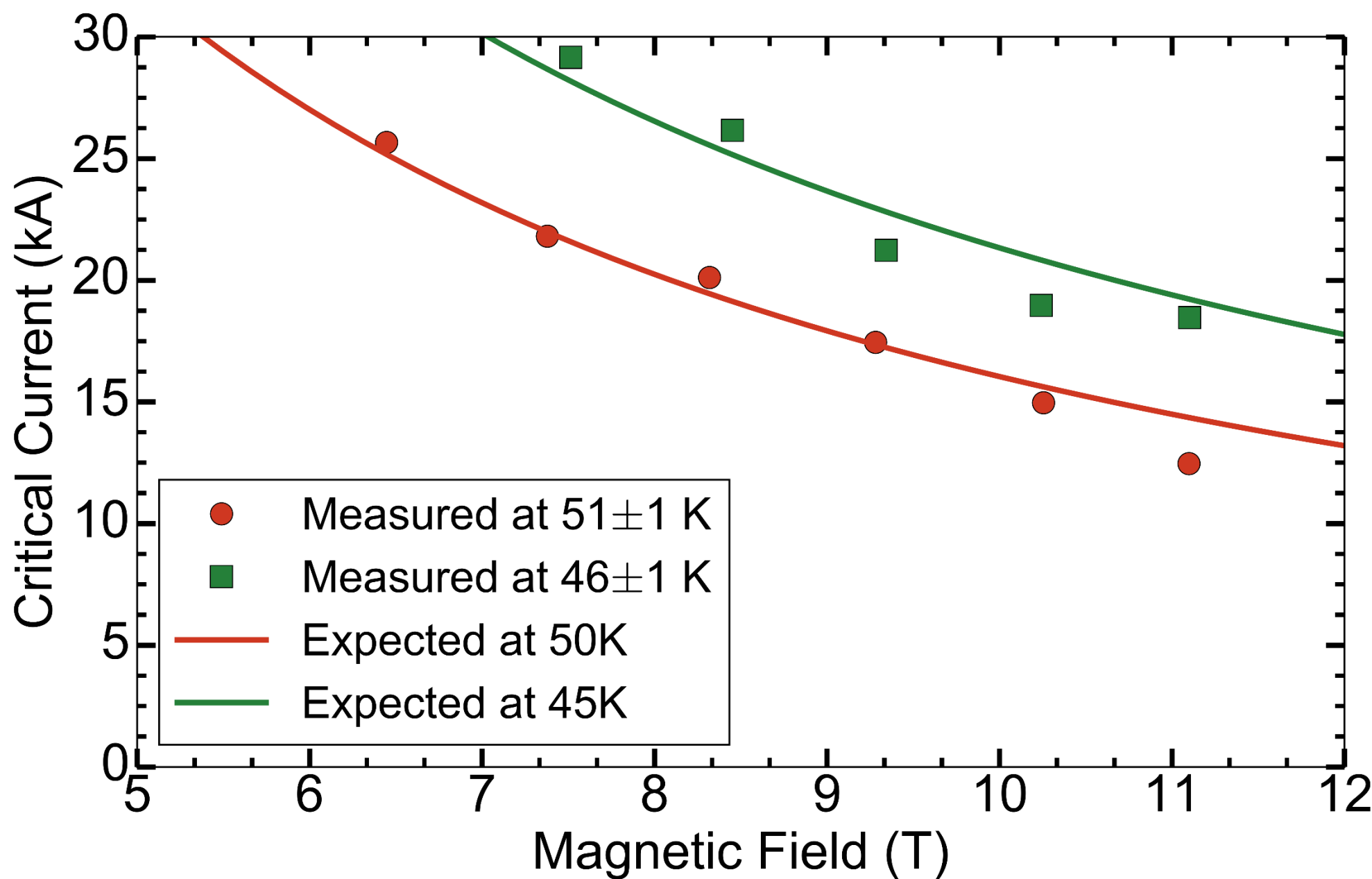
### CORC CICC for Detector Magnets:

- Aluminium Jacket (radiation transparency)
- Aluminium CORC Core (thermal shrinkage)
- External Conduction Cooling
- Operation at 15-30 K and 4-6 T

## Measurements



Measured AC-Losses for the CORC CICC designed for fusion magnets. It is assumed the losses are mainly caused by eddy currents, given the large copper tube around the cable.



Measured critical current of the CORC CICC designed for fusion as function of magnetic field in temperatures between 40 and 55 K. The results are in line with the expectations.

## Current Design – Production – Test Status

### CORC CICC with aluminium jacket was manufactured and tested in 2016

- ✓ CICC was rated for 48 kA at 4.2K and 10 T and 13 kA at 77 K and self-field.
- ✓ Tested in liquid nitrogen and self-field: behaved according to expectations.
- ✓ Tested in liquid helium and magnetic field of 9 T: reached facility limit.
- ✓ Joint terminals had low 2-4 nΩ resistance at 4.2 K

### CORC CICC for Fusion and Detector magnets were manufactured in 2017

- ✓ Both CICC are rated for 80 kA at 4.2 K and 12 T.
- ✓ Low AC-Losses in a CORC CICC for fusion.
- ✓ Tested so far in 40 - 55 K range: CICC for fusion behaved according to expectations.
- ✓ Low joint terminals resistance 1.5 - 3.0 nΩ.
- 4.5 - 40 K range will be tested in October.

