



First fully European CORC® cables

M. Vojenčiak, J. Šouc, M. Soloviov, F. Gömöry,
M. Falter, M. Baecker ,
M. Bauer, V. Große

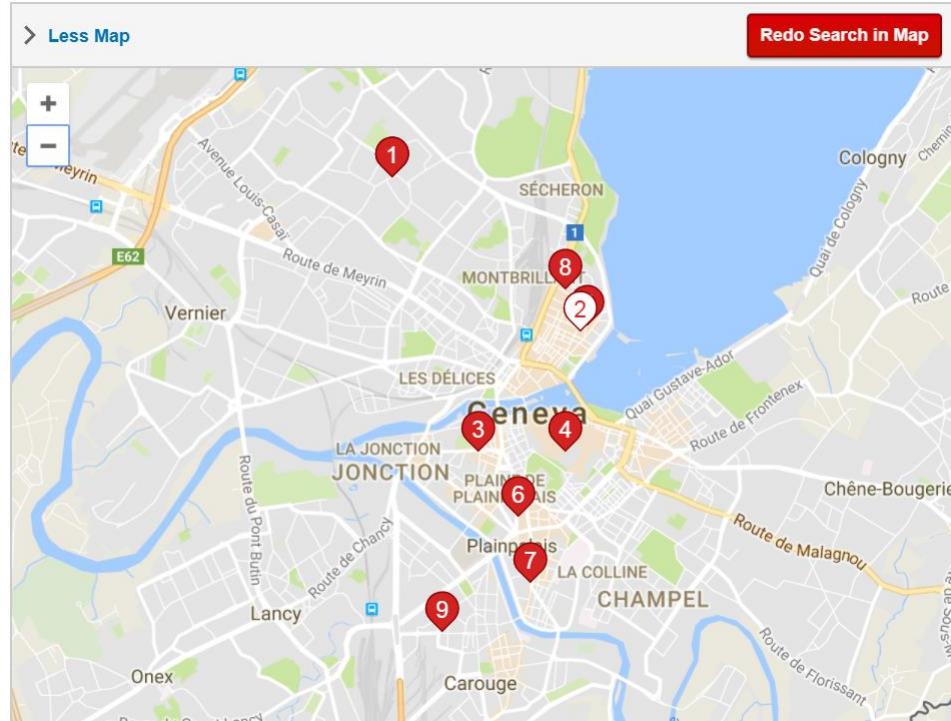
Introduction

Fondue



fondue restaurant geneva

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Introduction

Fondue



Gruyère cheese



White wine



Fondue pot

Can you use other kinds of cheese for delicious fondue?



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European REBCO coated conductors



EUROPEAN DEVELOPMENT OF SUPERCONDUCTING TAPES

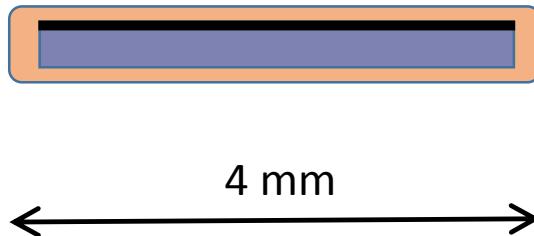


Coated conductors producers



European REBCO coated conductors

Deutsche Nanoschicht

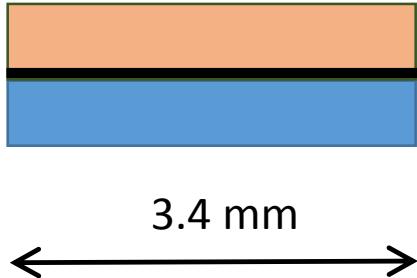


20 µm copper (surround)

CSD deposition technology

60 µm Ni5W substrate

THEVA



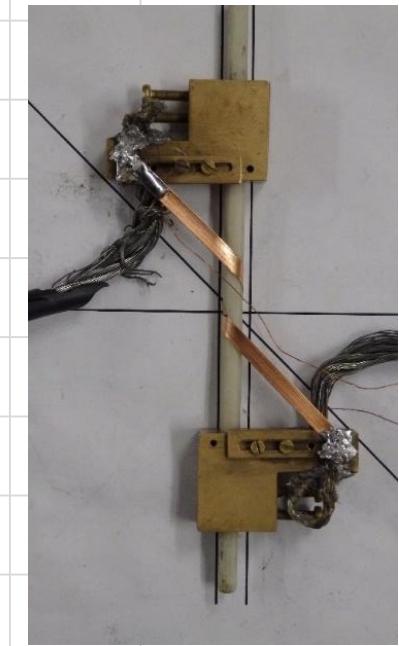
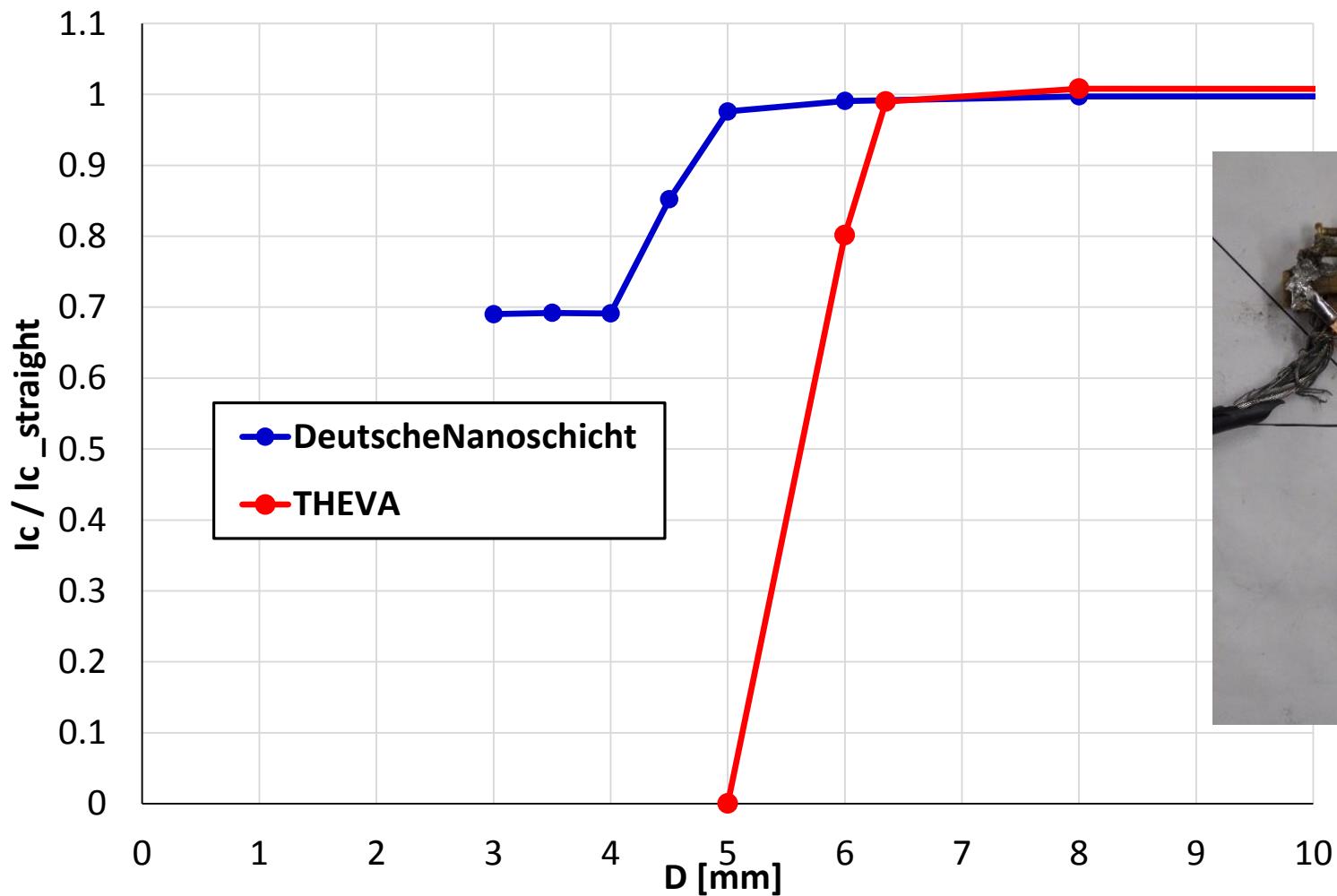
100 µm copper

PVD deposition technology

100 µm hastelloy

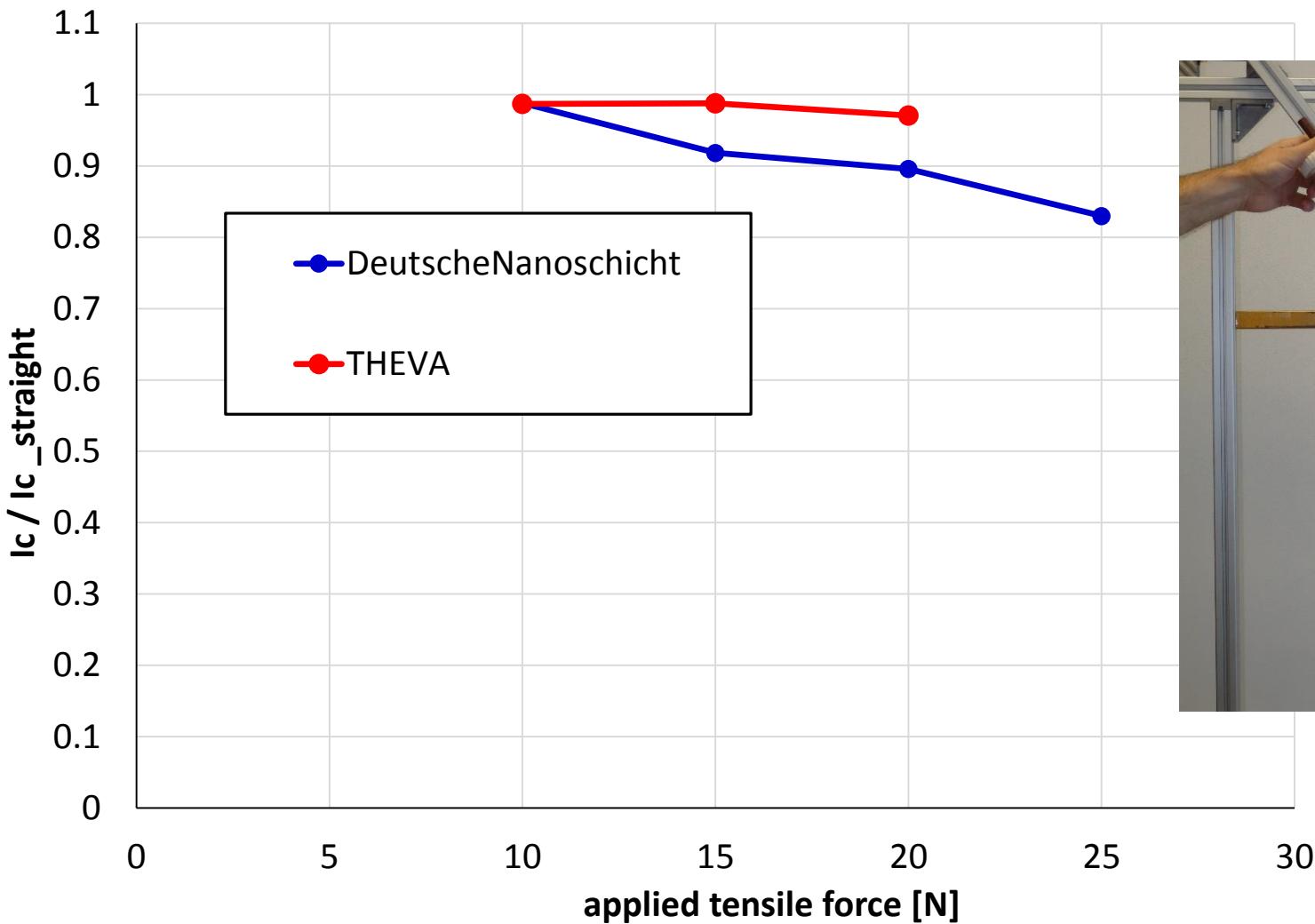
- different architecture
- different technology
- **different properties**

Off-axis bending test



6.35 mm former diameter acceptable for both tapes

Tensile force during winding



< 10 N tensile force need for Deutsche Nanoschicht tape

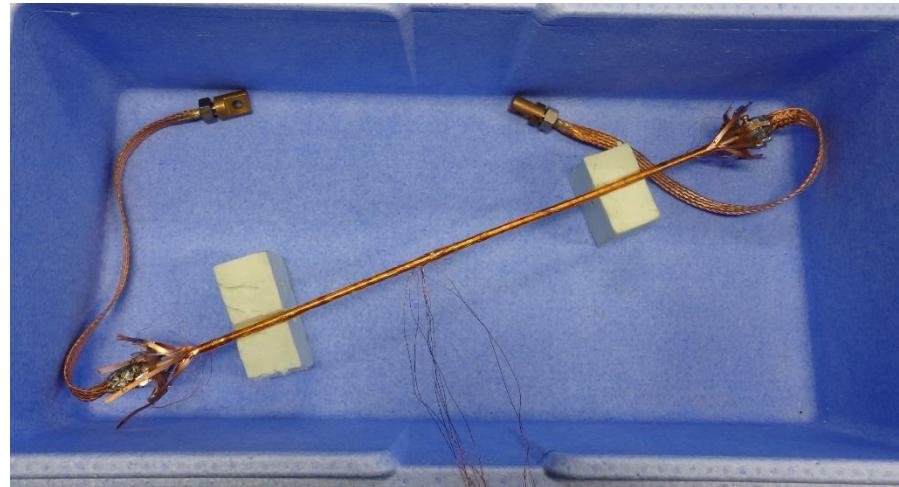
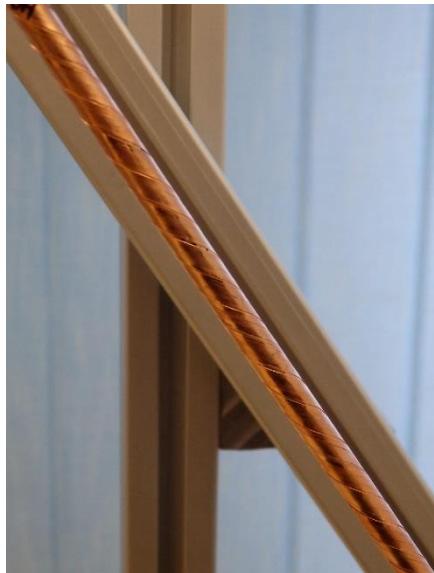
20 N tensile force acceptable for THEVA tape

DeutscheNanoschicht cable

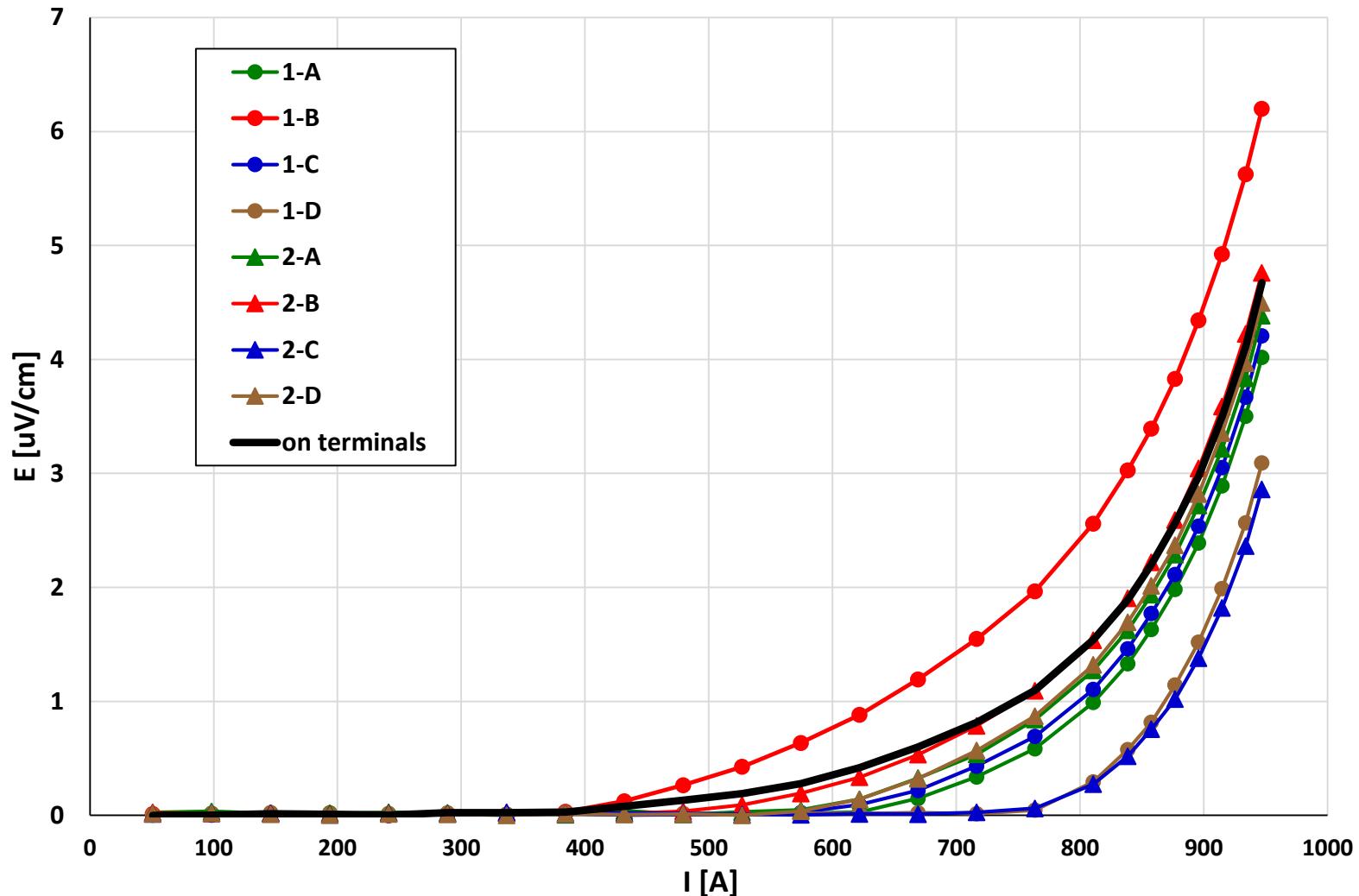


Deutsche Nanoschicht cable

- former diameter 6.35 mm
- 8 tapes
- two layers
- lay angle 32 degrees



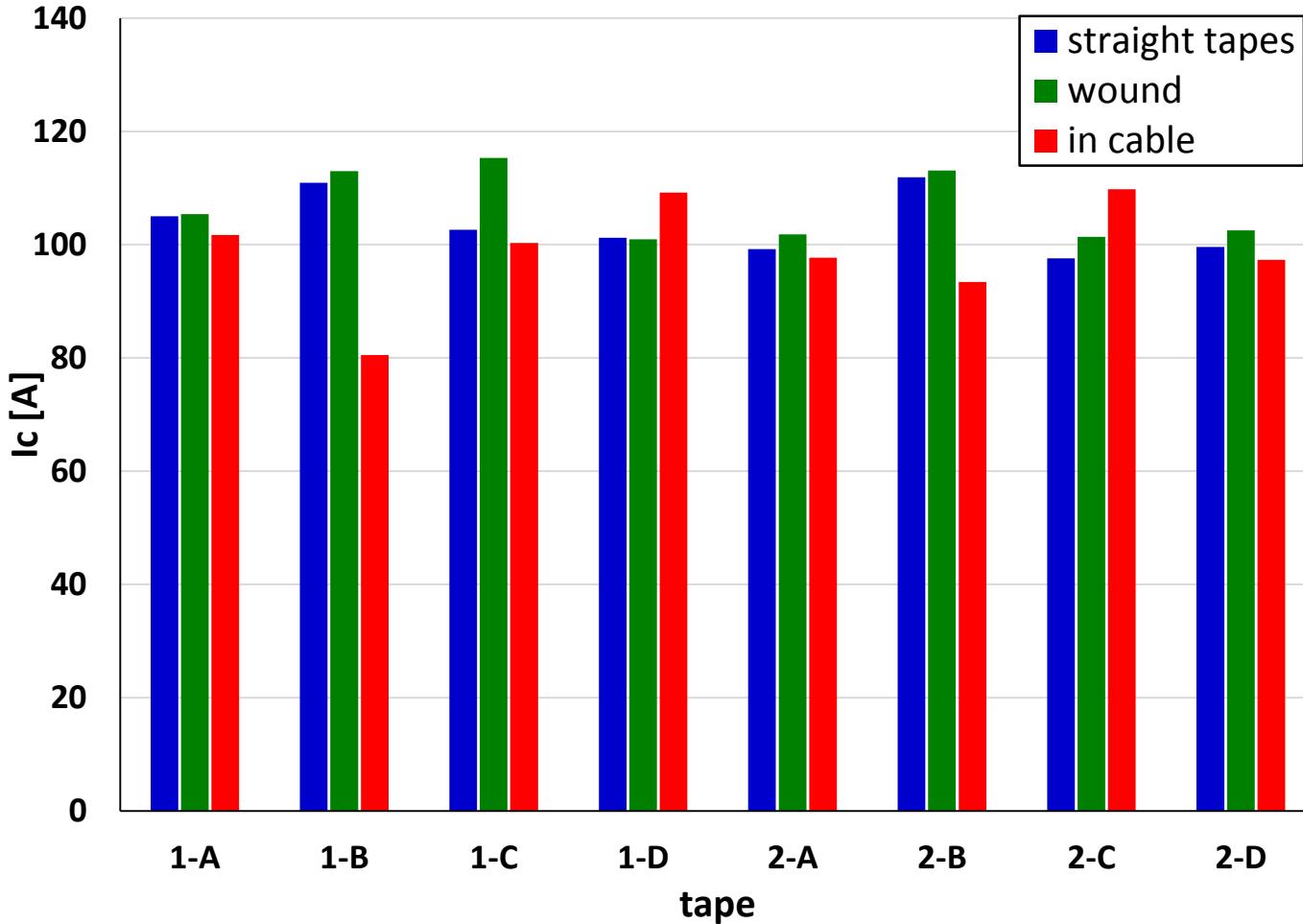
Critical current measurement



Critical current estimated from voltage on terminals

$I_c = 730.2 \text{ A}$

Individual tapes



$$\text{Straight tapes} \quad \sum I_c = 828 \text{ A}$$

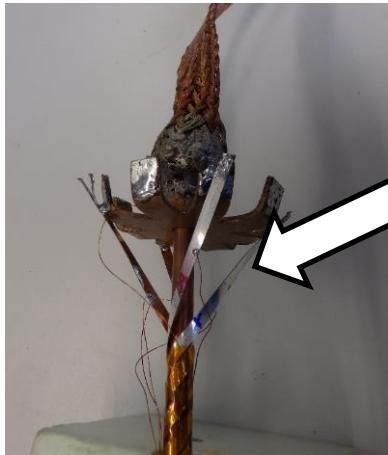
$$\text{Wound tapes} \quad \sum I_c = 853.5 \text{ A}$$

$$\text{Tapes in cable} \quad \sum I_c = 789.9 \text{ A}$$

Terminals are essential for cable performance

Forced flow cooling

Current leads



Tape is not in contact
with copper



Terminals suitable for
forced-flow cooling

Thermal insulation (non-vacuum)

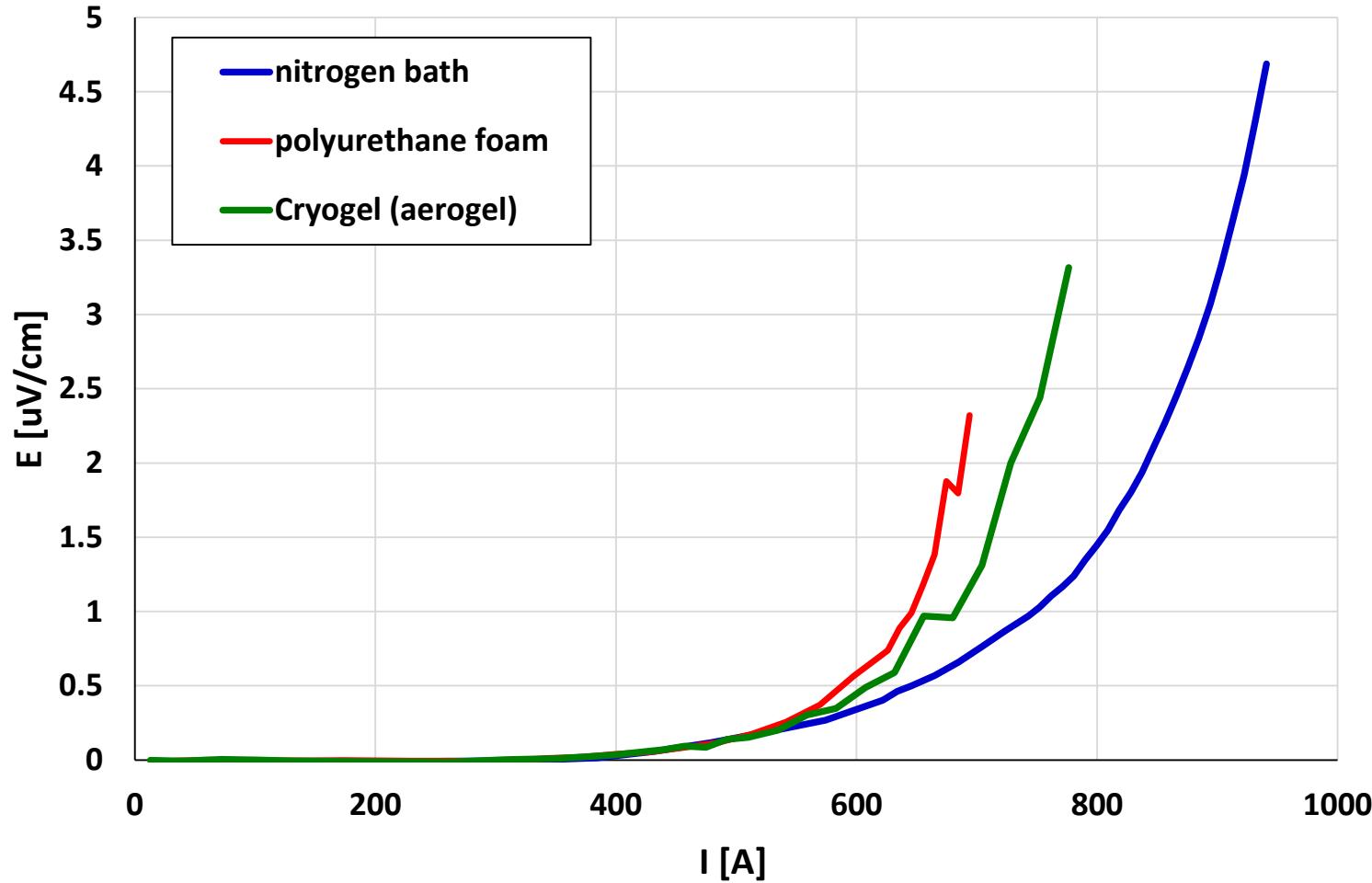


Rigid polyurethane foam



Aerogel (cryogel)

Forced flow cooling – liquid nitrogen flow inside former



Polyurethane foam – 14 % critical current reduction

Cryogel – 9.5 % critical current reduction

Temperature increase $\sim 1 - 2 \text{ K}$

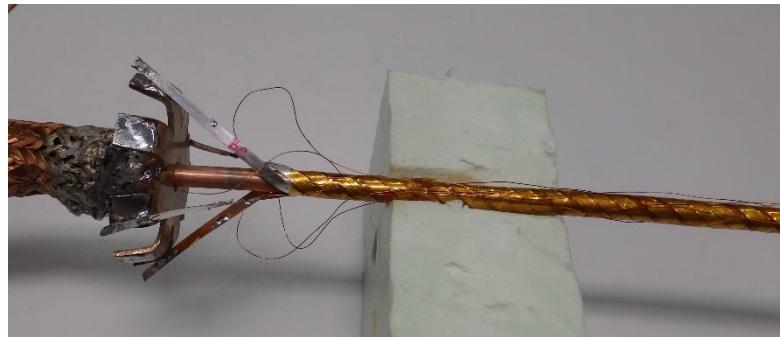
CORC cable can be tested (used) in forced flow conditions using non-vacuum insulation

THEVA cable

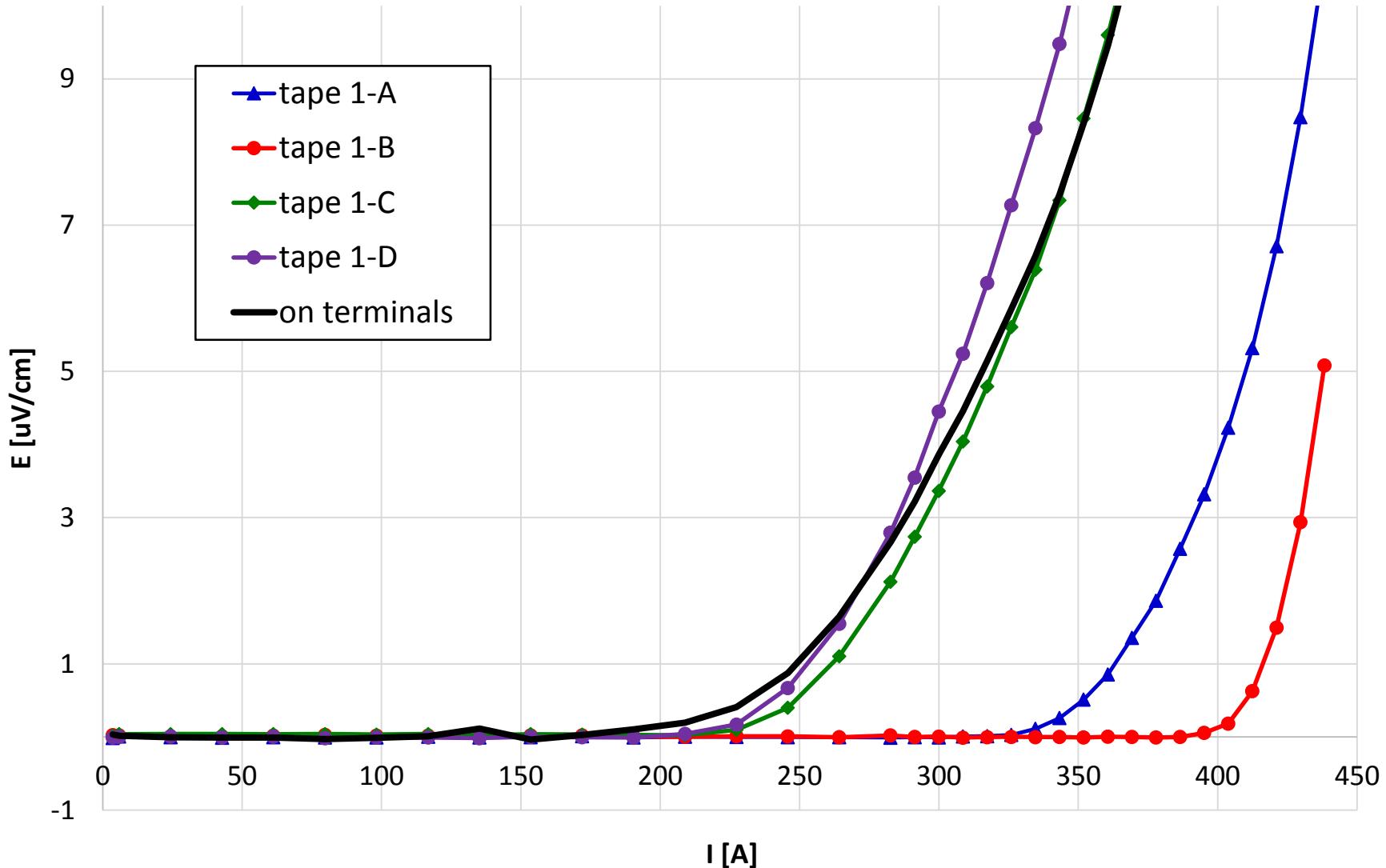


THEVA cable

- former diameter 6.35 mm
- 4 tapes
- single layer
- lay angle 41 degrees

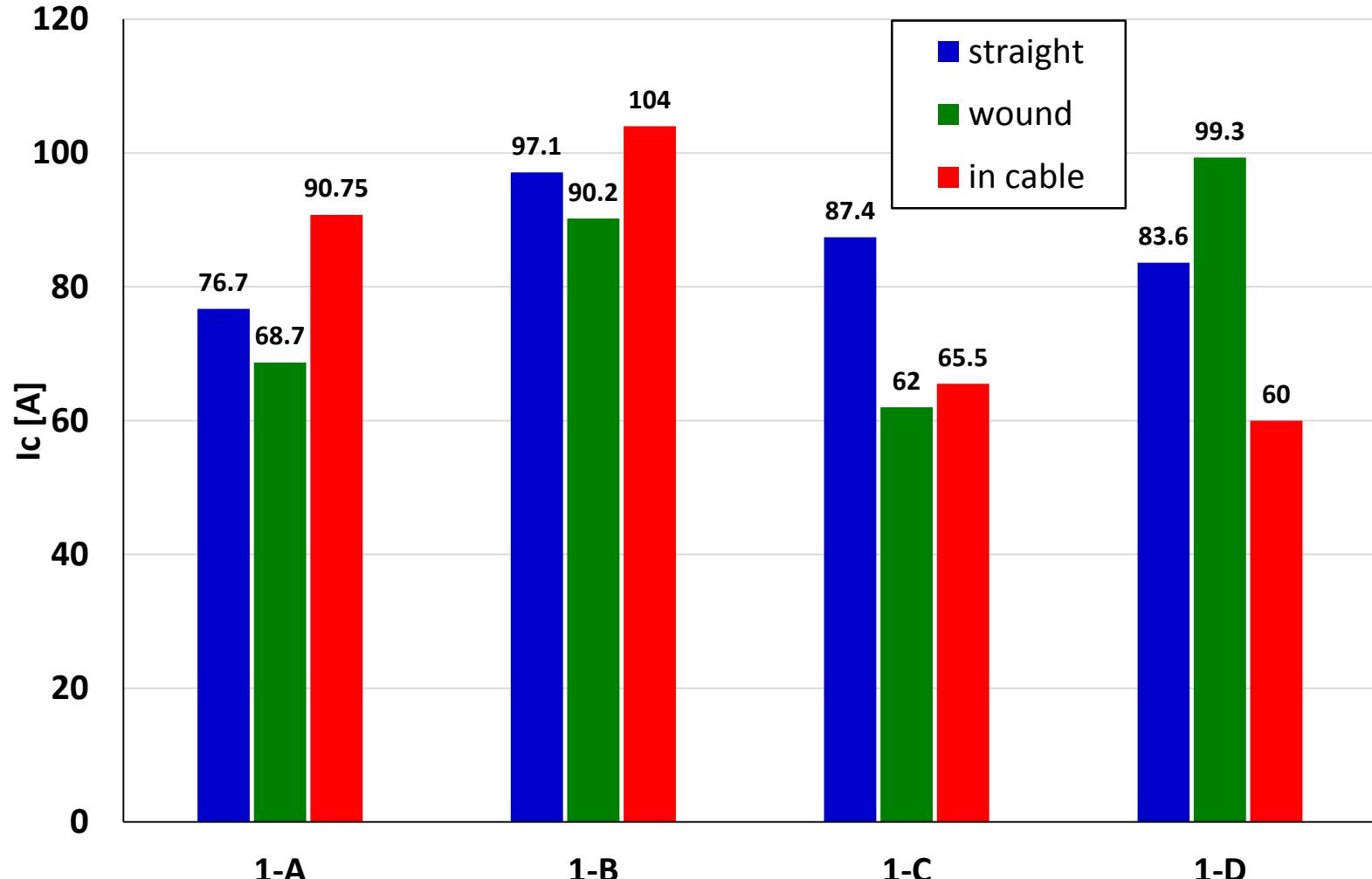


Critical current measurement



Strongly inhomogeneous current distribution – problem with terminals, not tapes themselves

Individual tapes



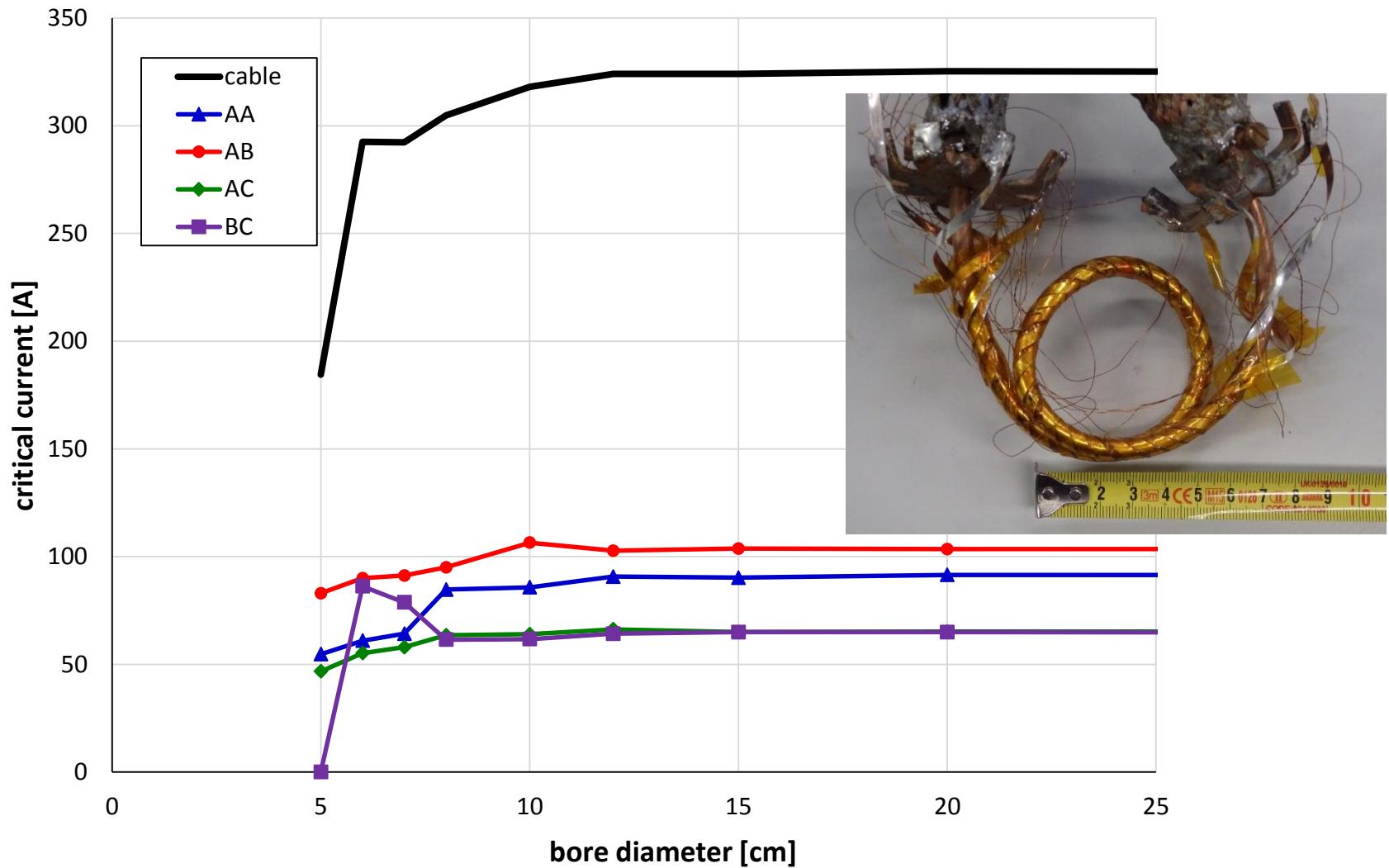
Straight tapes $\sum I_c = 344.8 \text{ A}$

Wound tapes $\sum I_c = 320.2 \text{ A}$

Tapes in cable $\sum I_c = 320.25 \text{ A}$

Only small degradation caused by cabling process

Cable bending



Cable is flexible, it can be bent down to diameters ~ 10 cm without degradation

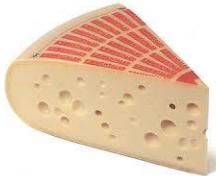
Conclusions - I

CORC cable is very flexible – allow bending down to 5 cm diameter
(even when tape experience high stress during cabling)

Forced flow cooling is applicable for CORC cable testing

Conclusions - II

There are many kinds of swiss cheese suitable for fondue



but not all of them !!!!

I can't say conclusion about all *REBCO* tapes,

but



are suitable for CORC cables