MANUFACTURING OF THE EUCARD2 ROEBEL-BASED COS-THETA COILS AT CEA SACLAY

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TARGET

Accelerator-type magnet
Target field in stand-alone mode + yoke : 5 T
Target field in insert mode: the more the better

CONSTRAINTS

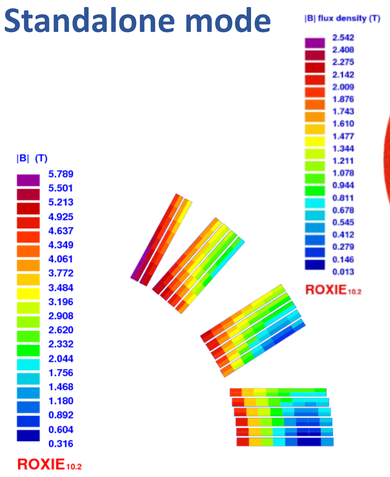
Magnet dimension: 40 mm aperture
FRESCA2 outsert magnet aperture 100 mm
→ 98 mm outer diameter

ROEBEL CABLE

EuCARD2 « thin » cable 12 x 1.0 mm²
15 tapes, 100 µm thick; cable thickness 0.8-1 mm
easyway bend radius > 10 mm
hardway bend radius > 2 m

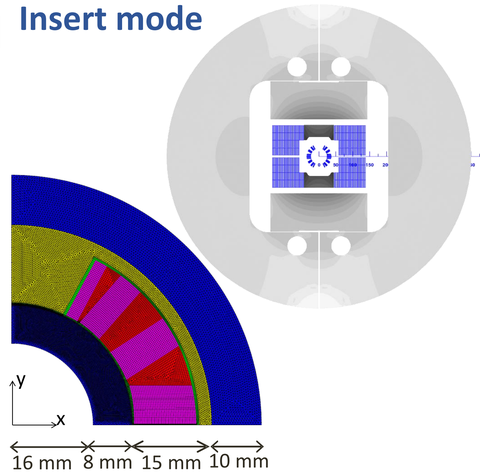
MAGNET DESIGN

Standalone mode



Standalone	Cosϑ B
Iop	**10.06 kA**
Bop	**5 T**
Bpeak	5.8 T
Ic	15.2 kA
LL margin	**34 %**
T margin	30 K
Sd. inductance	0.73 mH/m
coil inner radius	24 mm
yoke inner raidus	50 mm
yoke outer raidus	110 mm
Nb. of turns	17
Unit length of cond.	24 m

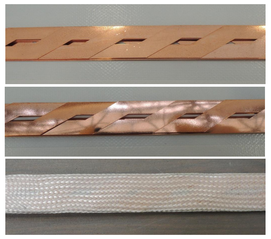
Insert mode

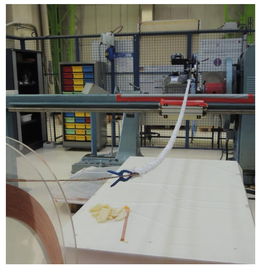


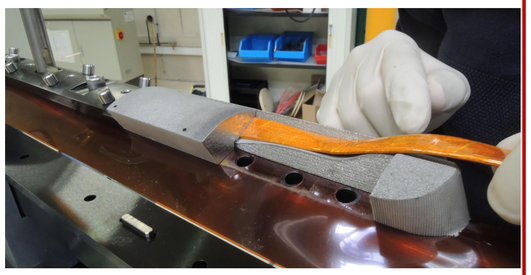
Insert mode	Cosϑ B
Iop	**7.1 kA**
Bop	**2.6 + 13 T**
LL margin	**10 %**
T margin	8 K
S. inductance	0.55 mH/m
M. inductance	1.77 mH/m
inner tube th.	8 mm
bore radius	16 mm
outer shell th.	10 mm
external radius	49 mm
Fx per ½ coil	1669 kN/m
Fy per ½ coil	-95 kN/m
Fz	90 kN
von Mises inner	760 MPa
von Mises outer	250 MPa

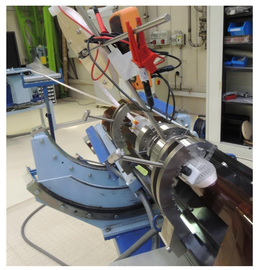
COILS MANUFACTURING

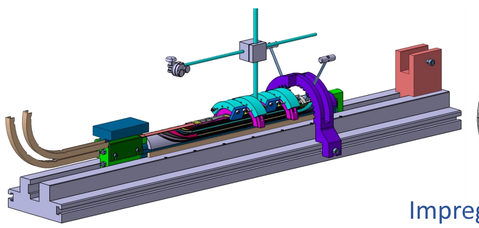
Cable preparation



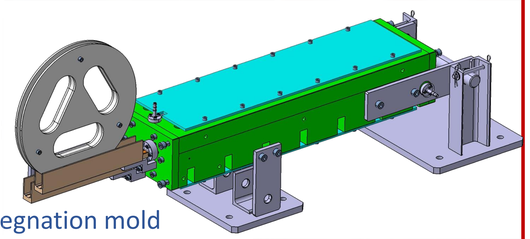




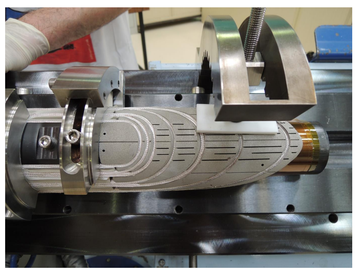


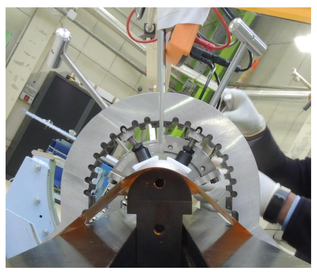


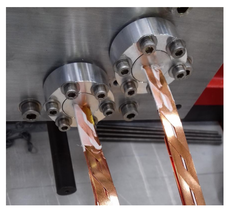
Winding tooling



Impregnation mold







Cable sealing system

Impregnation system

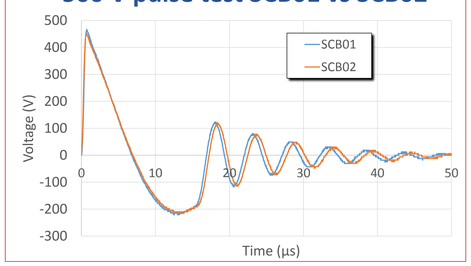
SUPERCONDUCTING COILS

Superconducting coil SCB01

Superconducting coil SCB02 (with cable ends protection)

Coil SCB01 wound with the SC layer of the strands outside side instead of inside side as foreseen.

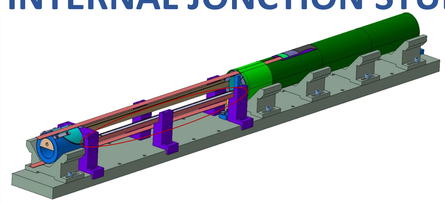
500 V pulse test SCB01 vs SCB02

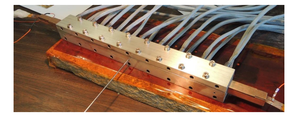


Coil inductance (µH)

Estimated	SCB01	SCB02
94	85,14	88,05

INTERNAL JONCTION STUDIES

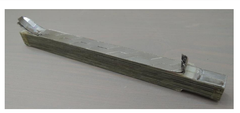




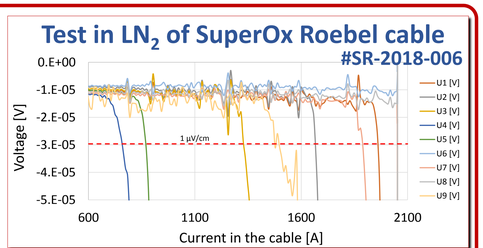
Resistance measurements in LN_2 (600 A)

SC/SC joints R : 4-6 nΩ
Hast/Hast joints R : 20 nΩ

CABLE STUDIES



Test in LN_2 of SuperOx Roebel cable #SR-2018-006



Cable Ic ~ 2000 A at 77K

Inter turn insulation tests: dielectric breakdown around 2250V

NEXT

Superconducting coil no. 3 will be wound next October.
Magnet assembly (coils 2 and 3) is foreseen by the end of 2019.
Coil 1 will be kept as spare. Tests in LN2 on SuperOx cable are ongoing to verify bending impact on cable performances.

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