EuCARD-2 dipole status: cos-ϑ

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(CEA)

1 - dec - 2015
CERN

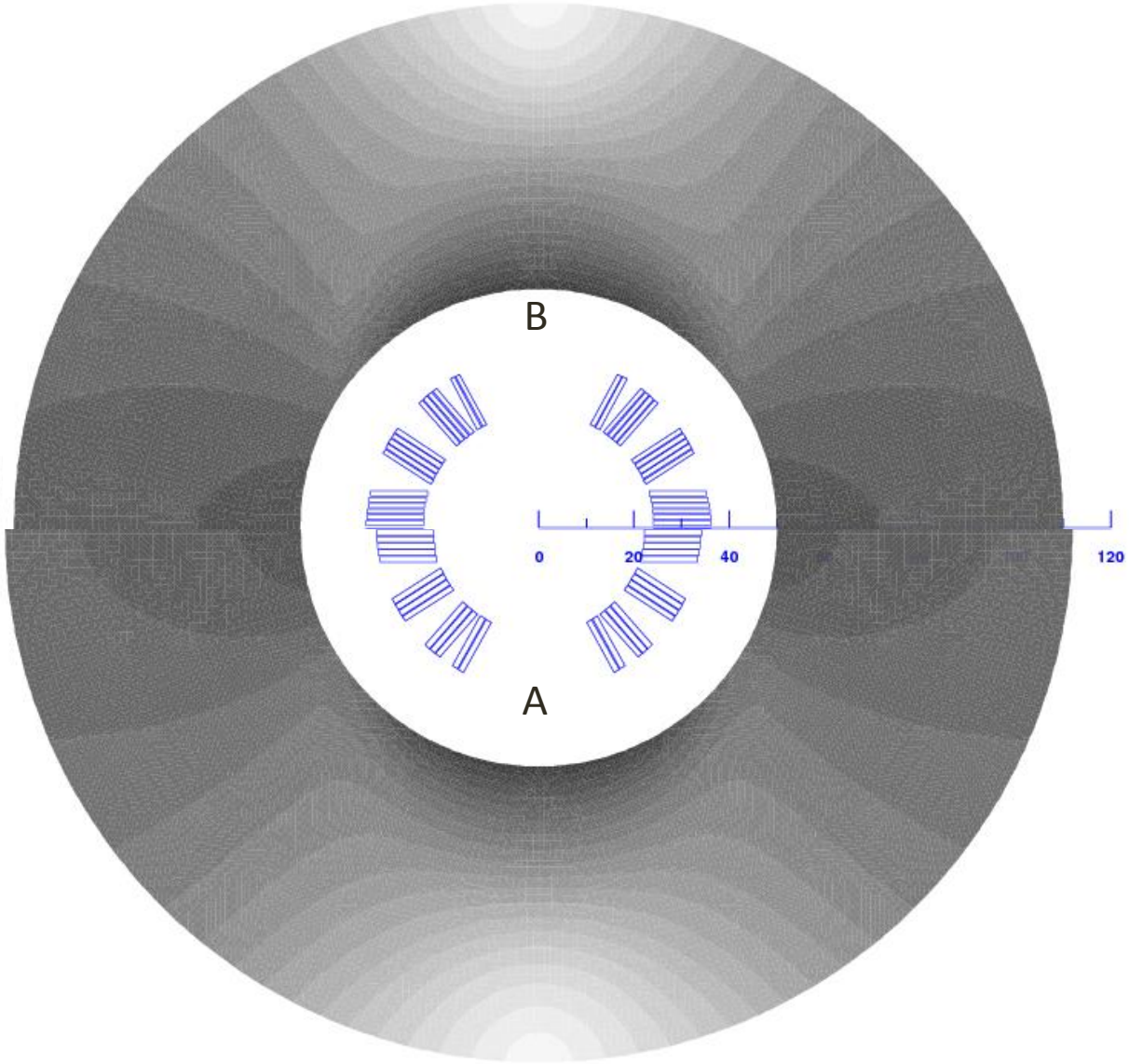
Acknowledgements: Arnaud Acker and Jean-François Millot

Roebel cable options

- Two cable options
  - 13 x 140 µm tapes (baseline: Bruker) leading to magnet design A
    - 12 x 1.2 mm² with 100 µm insulation
  - 15 x 100 µm tapes (plan B) leading to magnet design B
    - 12 x 1.0 mm² with 125 µm insulation
  - In both cases: 12.0 mm total width, 300 mm twist pitch, 5.5-5.9 mm meander width
  - Performance: $J_{e,tape}$ (18 T, 4.2 K, //c) = 600 A/mm²

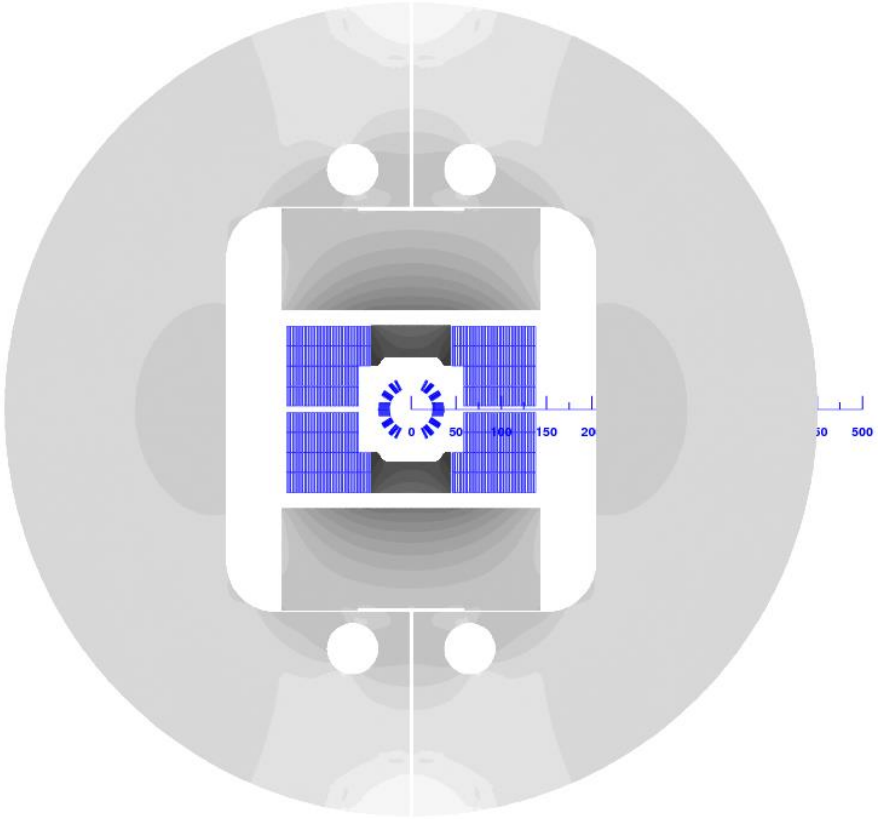
Magnetism Standalone Mode

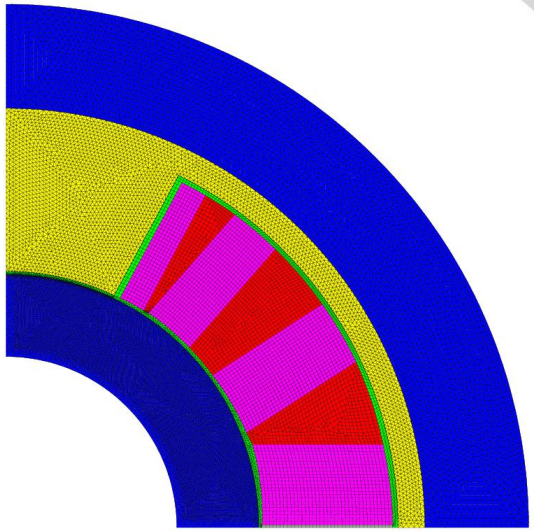
Layout	Unit	Cosϑ A	Cosϑ B
Iop	kA	11.68	10.06
Bop	T	5	5
Bpeak	T	5.7	5.8
Ic	kA	14.4	15.2
LL margin	(%)	20	34
T margin	K	20	30
Sd. inductance	mH/m	0.49	0.73
coil inner radius	mm	22	24
yoke inner raidus	mm	50	50
yoke outer raidus	mm	112	110
Nb. of turns	-	14	17
Unit len. of cond.	m	20	24



Magnetism & Mechanics Insert Mode

Layout	Unit	Cosϑ A	Cosϑ B
Iop	kA	6.4	7.1
Bop	T	2.1 + 13	2.6 + 13
Ic	kA	7.1	7.9
LL margin	(%)	10	10
T margin	K	8	8
S. inductance	mH/m	0.37	0.55
M. inductance	mH/m	1.37	1.77
coil inner radius	mm	22	24
inner tube th.	mm	6	8
outer shell th.	mm	12	10
Fx per ½ coil	kN/m	1226	1669
Fy per ½ coil	kN/m	-60	-95
Fz	kN	61	90
σ_T	MPa	140	155
σ_R	MPa	75 (~50)	110 (~70)
azi. deflection	µm	125	140
von Mises inner	MPa	600	760
von Mises outer	MPa	240	250



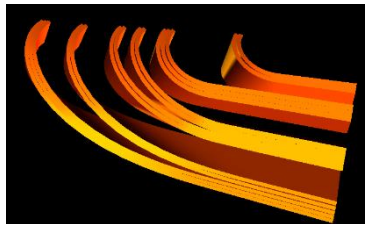


Layout	unit	Cosϑ A & B
bore radius	mm	16
external radius	mm	49
pad (collar) th.	mm	2.5

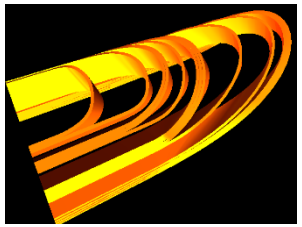
End designs

- Design A

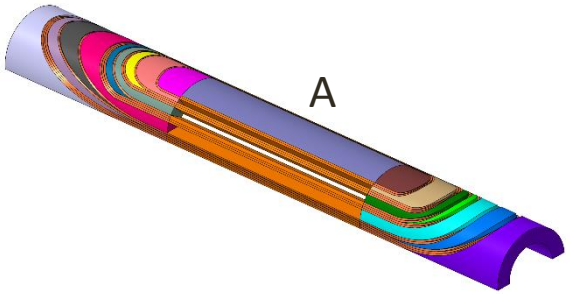
Return



Lead

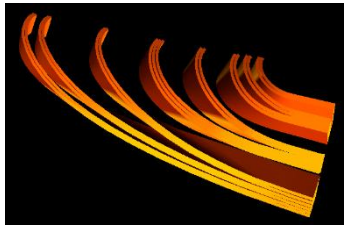


$(ew,hw)_{min}$	Cosϑ A	Cosϑ B
Return	(7.3 mm, 23 cm)	(7.9 mm, 32 cm)
Lead	(8.5 mm, 22 cm)	(8.3 mm, 27 cm)

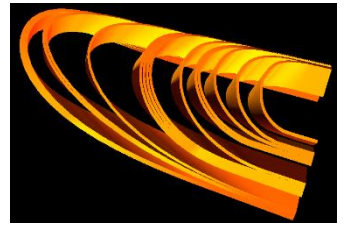


- Design B

Return

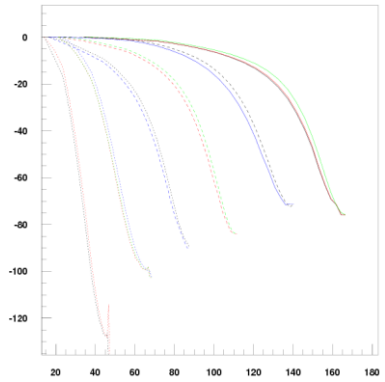


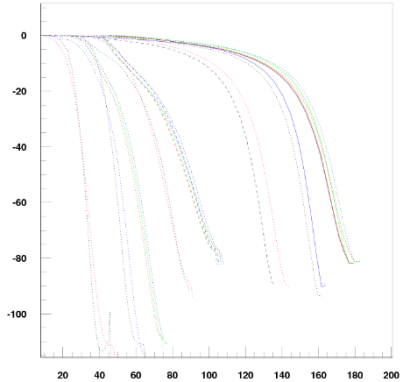
Lead

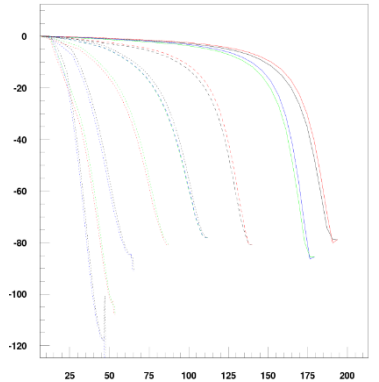


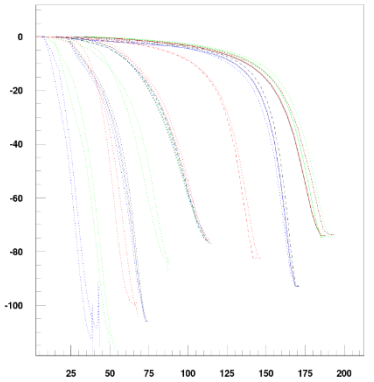
Curv. easyway

100 m^{-1} -> 10 mm



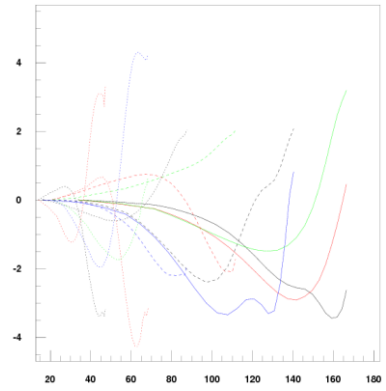


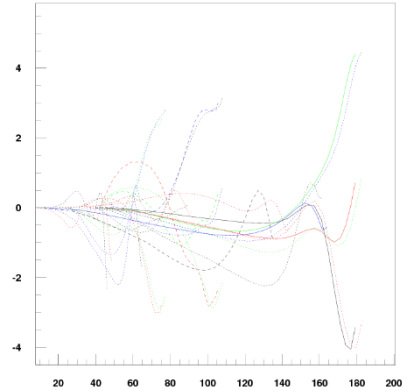


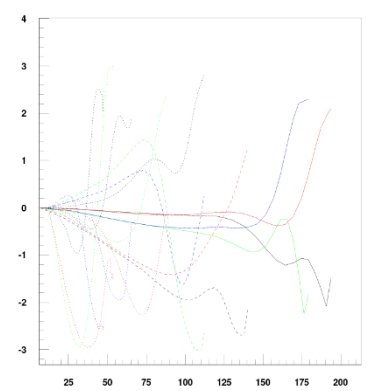


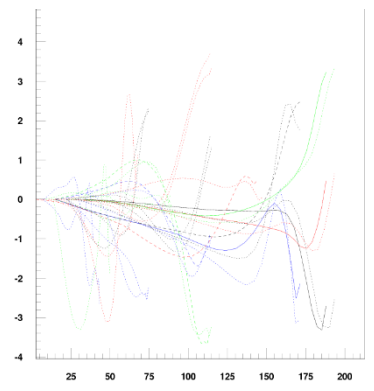
Curv. hardway

4 m^{-1} -> 25 cm



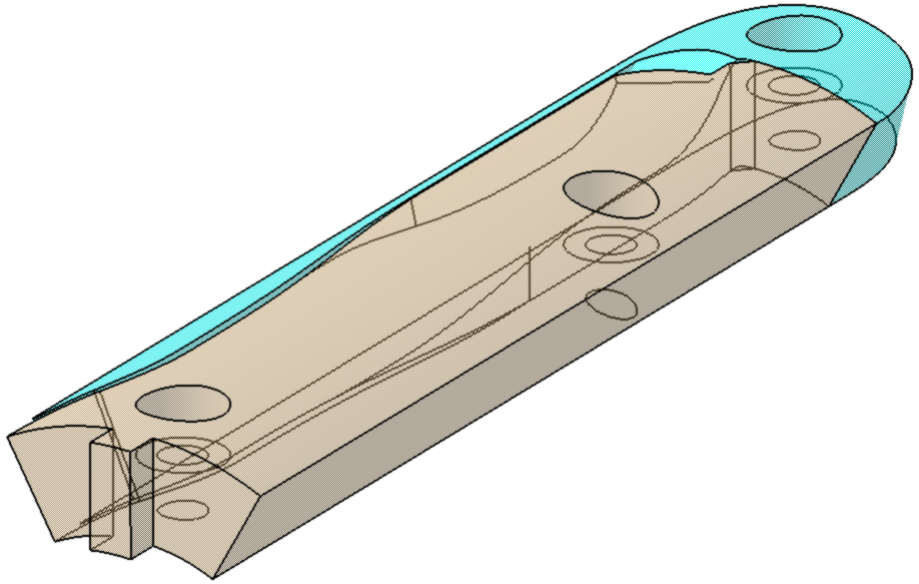




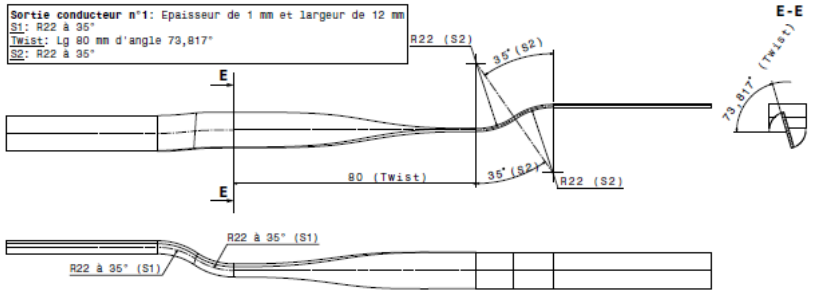


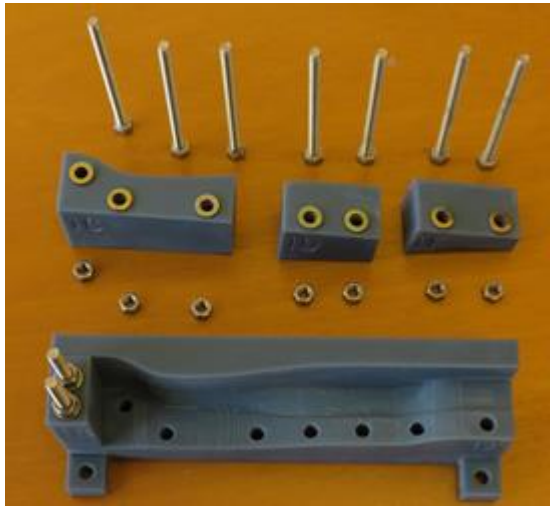
Conductor outwards path

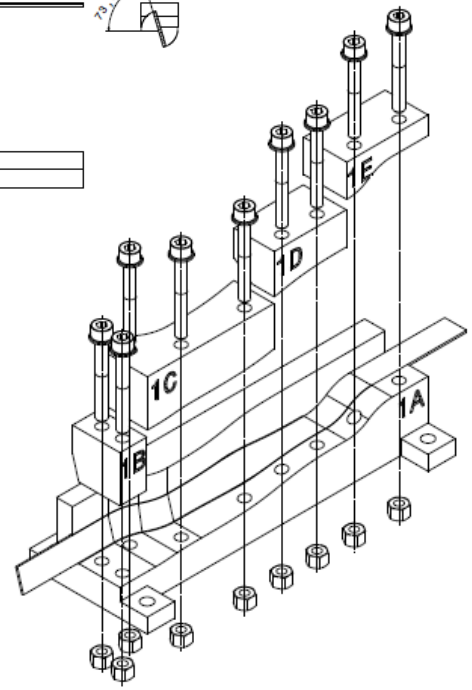
- Winding tests: July 2015



- Twisting tests: Jan 2016



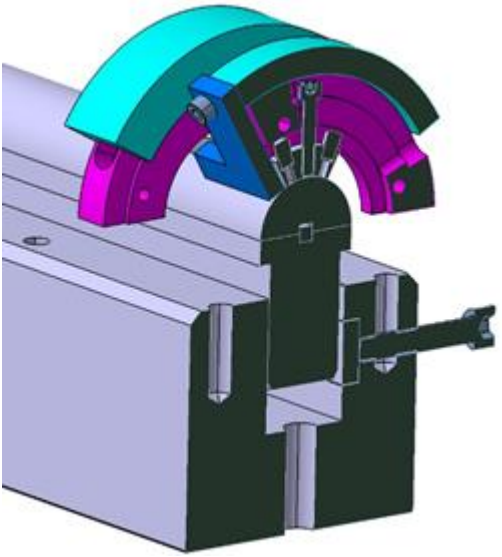


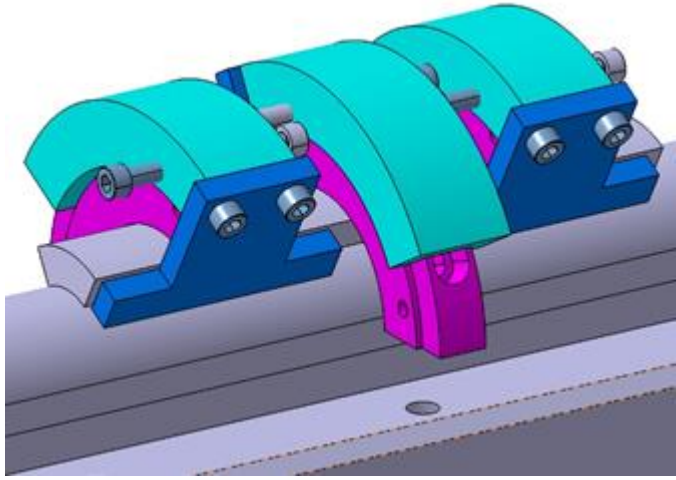


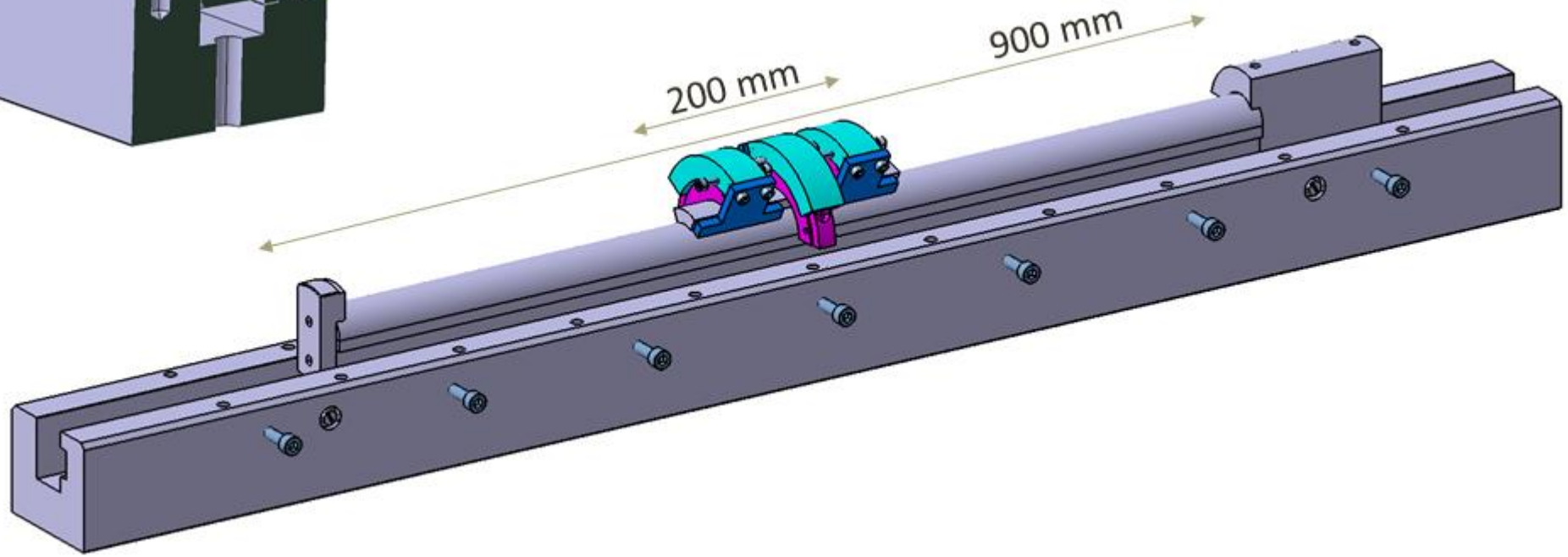
Designed at CEA - Printed at CERN – Tests to be done at KIT

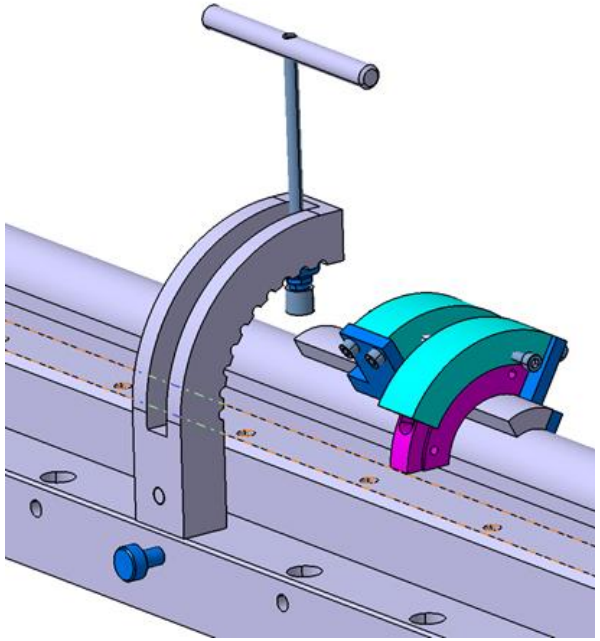
Arnaud Acker

Tooling: Mandrel – Beam – Central post -Tooling









Jean-François Millot

Planning

- Detailed drawings of coil (A&B) : End of December 2015
- CAD magnet and tooling 2D detailed drawings (A): End of February 2016
- Dummy cable: 2 x 20 m – End of March 2016
- Procurement (A): End of May 2016
- Superconducting cable: 3 x 20 m – End of June 2016
- Dummy coils (winding-impregnation): Mid of July 2016
- Dummy magnet assembling: End of July 2016

- Start working of SC magnet: September 2016