Quality Control of the dismounting of MBHDP102
First results – De-collaring process

Ricardo de Paz Ludena

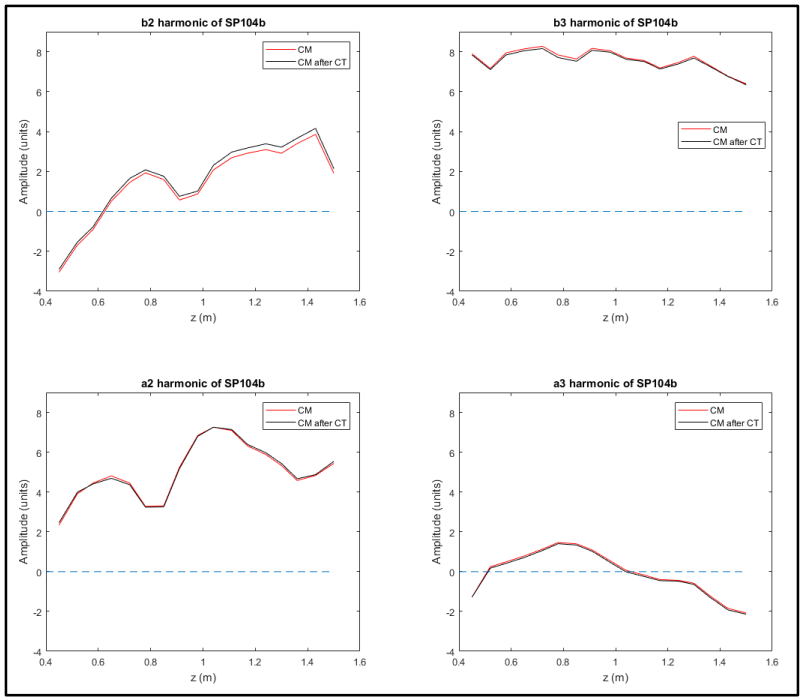
11T Dipole Task Force Meeting # - CERN – 21/02/2018

Programme of Disassembly of 11T DP102

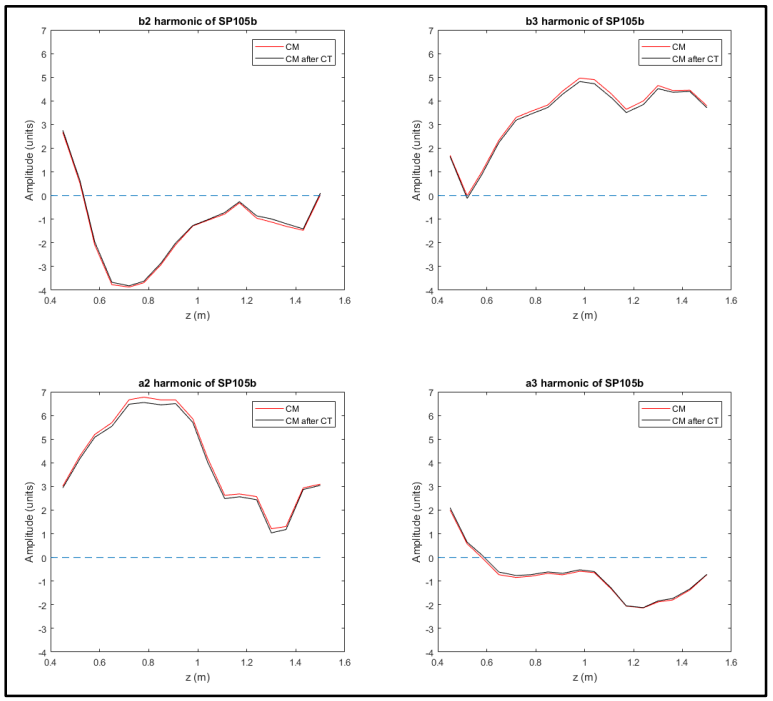
Magnet state	Step	Task	Personnel
CM	1	Transport from SM18 to 927.	
	2	Magnetic measurements at room temperature.	Lucio Fiscarelli
	3	Strain gauges measurements.	Philippe
	4	Electrical tests. Full assembly.	Francois-Olivier
	5	Removal of coils interconnection and instrumentation wires.	Hugues, Nicolas
	6	Transport to 180.	Gregory
	7	Shell cutting, disassembly of end plates, yoke and two collared coils.	Frederic's team
CC	8	Transport to 927 of 2 collared apertures.	Frederic's team
	9	Electrical tests. Collared coils.	Francois-Olivier
	10	Geometrical measurements of collared coils.	Salvador
	11	Strain gauges measurements.	Philippe
	12	Decollaring.	Nicolas, Ricardo and Philippe
Coils	13	Visual inspection.	Hugues, Nicolas, Ricardo
	14	Geometrical measurements of the coils.	Salvador
	15	Electrical tests. Coils.	Francois-Olivier
	16	Collars geometrical measurements on larger and smaller coil size contact areas.	Salvador
	17	Some coils will be cut to check the degraded areas (broken filaments).	

Magnetic Measurements: Cold mass Before / After cold tests

SP104b



SP105b



No significant variations Before / After cold test.

Courtesy of L. Fiscarelli

Magnetic Measurements: Cold mass Before / After cold tests

SP104b Average (- 520, 520 mm)

	CM before CT (units)		CM after CT (units)		Δ (units)	
n	bn	an	bn	an	bn	an
2	1.42	4.88	1.50	4.89	0.08	0.01
3	7.60	-0.20	7.37	-0.26	-0.23	-0.06
4	0.14	-0.58	0.07	-0.58	-0.07	0.00
5	2.06	-0.01	1.97	-0.01	-0.09	0.00
6	0.01	0.03	0.01	-0.03	0.00	-0.06

SP105b Average (- 520, 520 mm)

	CM before CT		CM after CT		Δ (units)	
n	bn	an	bn	an	bn	an
2	-1.38	4.20	-1.08	3.90	0.30	-0.30
3	3.49	-0.81	3.30	-0.73	-0.19	0.08
4	-0.39	0.75	-0.29	0.68	0.10	-0.07
5	0.89	-0.69	0.85	-0.64	-0.04	0.05
6	0.07	0.71	0.07	0.69	0.00	-0.03

No significant variations Before / After cold test.

Courtesy of L. Fiscarelli

Electrical Tests. VT and Insulation

SP104b

Insulation resistance	Test name		BC2	AC2	After Yoke Disassembled	After Decollaring	
	U[test]	time	measured	measured	measured	measured	nominal
	[V]	[s]	[GΩ]	[GΩ]	[GΩ]	[GΩ]	[GΩ]
coils + QHs ---> ground	1000	30	44.80	2.59	68.20	X	>1
coils ---> all QHs	1000	30	6.86	4.66	4.44	X	>1
coils ---> ground	1000	30	55.10	3.27	55.70	X	>1
coil109 ---> QHs109	1000	30	18.00	8.46	7.73	20.80	>1
coil112 ---> QHs112	1000	30	17.40	15.60	13.95	16.30	>1
coil109 ---> coil112	1000	30	77.20	6.20	8.87	X	>1
coil109 ---> Loading plate	1000	30	X	X	X	0.73	>1
coil112 ---> Loading plate	1000	30	X	X	X	Brd 957V	>1

- Insulation test 1000 V
- After-decollaring measurements being run today on SP105b coils.

- Insulation SP104b coils to Loading plate, NOT GOOD.

- CM to CC, we lost 4 VT in SP105b:
  EE115O6, EE115O5, EE114O5, EE114O6

- CC to Coils, RECOVERED.
  And we have lost EE115I4 and EE115O12

SP105b

Insulation resistance	Test name		BC2	AC2	After Yoke Disassembled	
	U[test]	time	measured	measured	measured	nominal
	[V]	[s]	[GΩ]	[GΩ]	[GΩ]	[GΩ]
coils + QHs ---> ground	1000	30	6.75	37.70	25.60	>1
coils ---> all QHs	1000	30	3.70	3.91	4.51	>1
coils ---> ground	1000	30	6.80	84.00	34.10	>1
coil114 ---> QHs114	1000	30	11.80	8.20	9.28	>1
coil115 ---> QHs115	1000	30	11.00	11.20	13.43	>1
coil114 ---> coil115	1000	30	61.00	47.30	13.41	>1
coil114 ---> Loading plate	1000	30	X	X	X	>1
coil115 ---> Loading plate	1000	30	X	X	X	>1

Courtesy of F.O Pincot

Electrical Tests. Coil discharge

SP104b

Test name		BC2	AC2	After Yoke Disassembled	After Decollaring
Time constant T		T Measured [µs]	T Measured [µs]	T Measured [µs]	T Measured [µs]
coil 109	0.5kV	OK	OK	OK	OK
	0.75kV	OK	OK	OK	OK
	1.0kV	OK	OK	OK	OK
coil 112	0.5kV	OK	OK	OK	OK
	0.75kV	OK	OK	OK	OK
	1.0kV	OK	OK	OK	OK

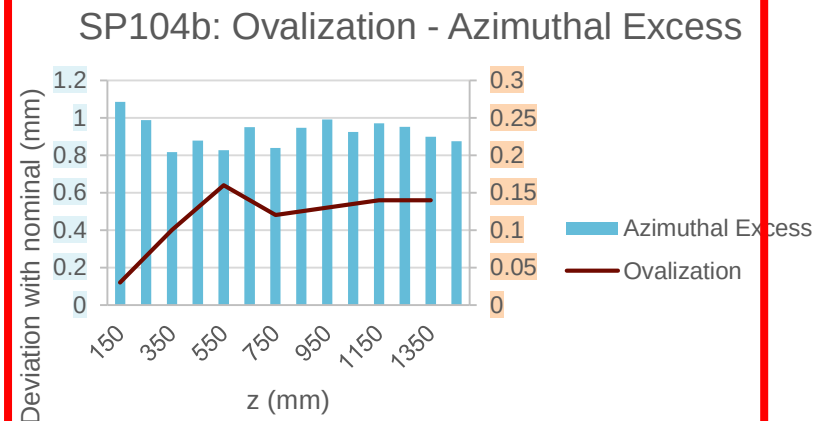
SP105b

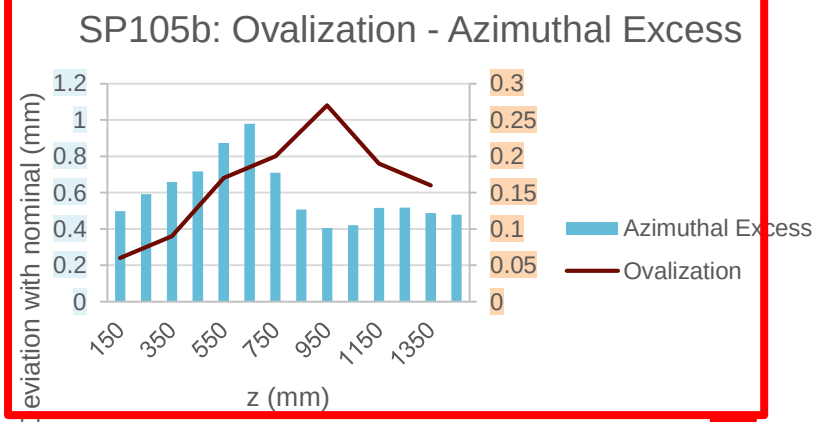
Test name		BC2	AC2	After Yoke Disassembled
Time constant T		T Measured [µs]	T Measured [µs]	T Measured [µs]
coil 114	0.5kV	OK	OK	OK
	0.75kV	OK	OK	OK
	1.0kV	OK	OK	OK
coil 115	0.5kV	OK	OK	OK
	0.75kV	OK	OK	OK
	1.0kV	OK	OK	OK

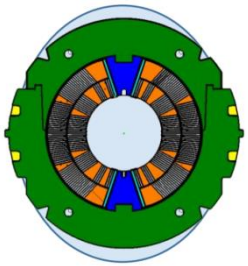
- **Coil discharge up to 1000 V done, everything OK**
- **After-decollaring measurements still to be performed on SP105b coils**

Courtesy of F.O Pincot

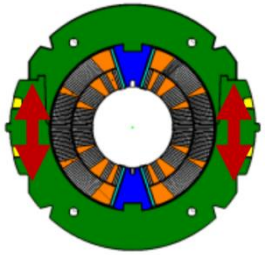
Geometrical measurements CC







- No correlation between azimuthal excess and ovalization of CC…?
- Deviation with the nominal **up to 0.27 mm for SP105b**.



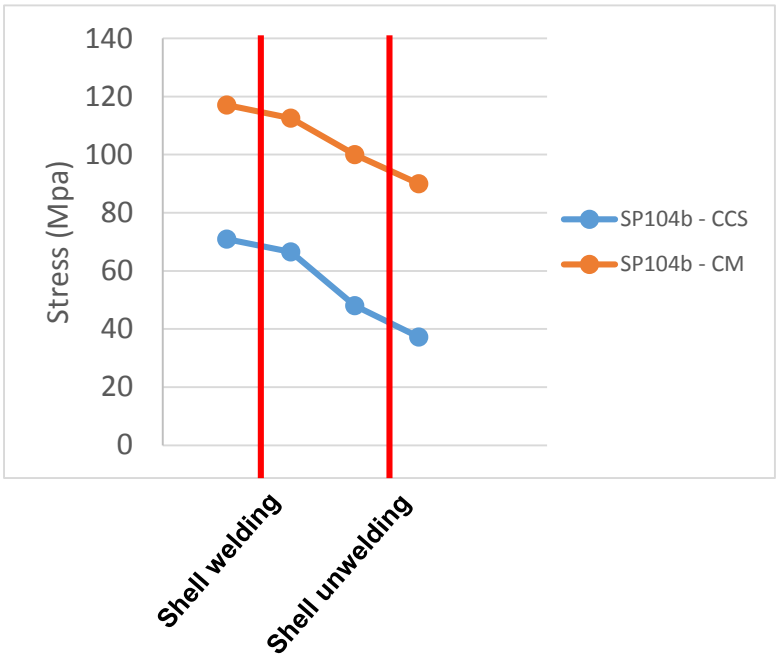
- Deviation of “keys” distances with nominal are **inside of the range (-0.03 , 0.06).**

To be compared with coil measurements, BEING PERFORMED DURING THIS WEEK

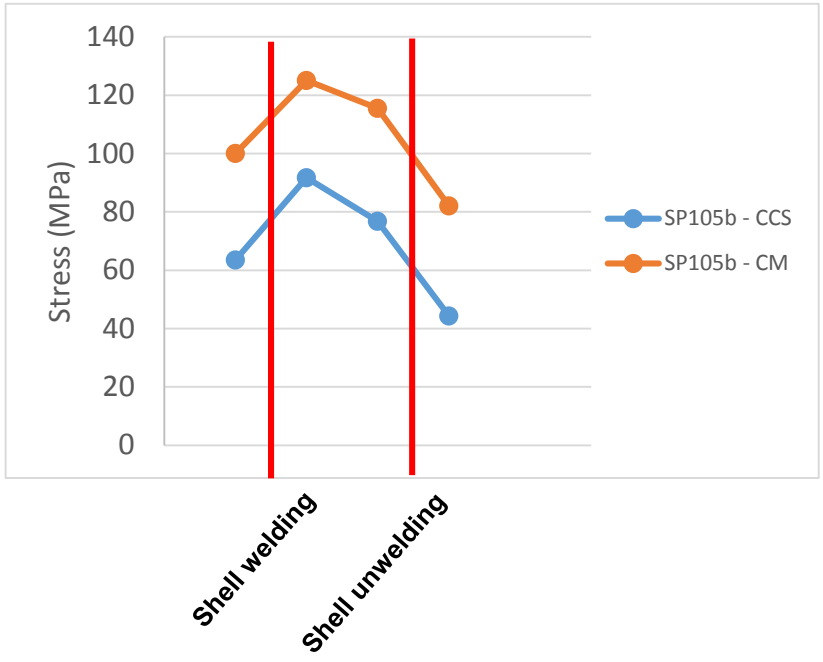
Unexpected correlation

Courtesy of S. Ferradas

Strain Gauges measurements. Welding – Unwelding variations



Loss 5 MPa **Loss 10 MPa**



Gain 25 MPa **Loss 34 MPa**

* Loss of stress on the collar noses during shell welding of SP104b.
Wrong data?

Courtesy of P. Grosclaude

Strain Gauges measurements. Decollaring

- **Shim between stoppers: 0.15 mm**

- **Removal of the keys ≈ 8 MN**

- Collaring of SP106: 10MN to perfectly close the tooling with a shim of 0.15mm (control with LVDT).

➔ < 10 MN: all force to the collared coil.
>10 MN: **part of the force is going to the tooling**

How much?

Observing SG in the middle of straight section during collaring of SP104b and SP105b:

6 MN – 12 MN ➔ 7 MPa/MN
12 MN – 16 MN ➔ 3.5 MPa/MN

Half of the force?

Courtesy of N. Bourcey

Conclusions

- **Electrical, Mechanical, Geometrical and Magnetic** measurements have been performed at the different disassembly states of DP102: CM ➔ CC ➔ Coils
    - Magnetic measurements apparently ok.
    - Electrical: insulation and discharge are ok. Some VT out of service.
    - Geometrical: analysis and coil measurements ongoing.

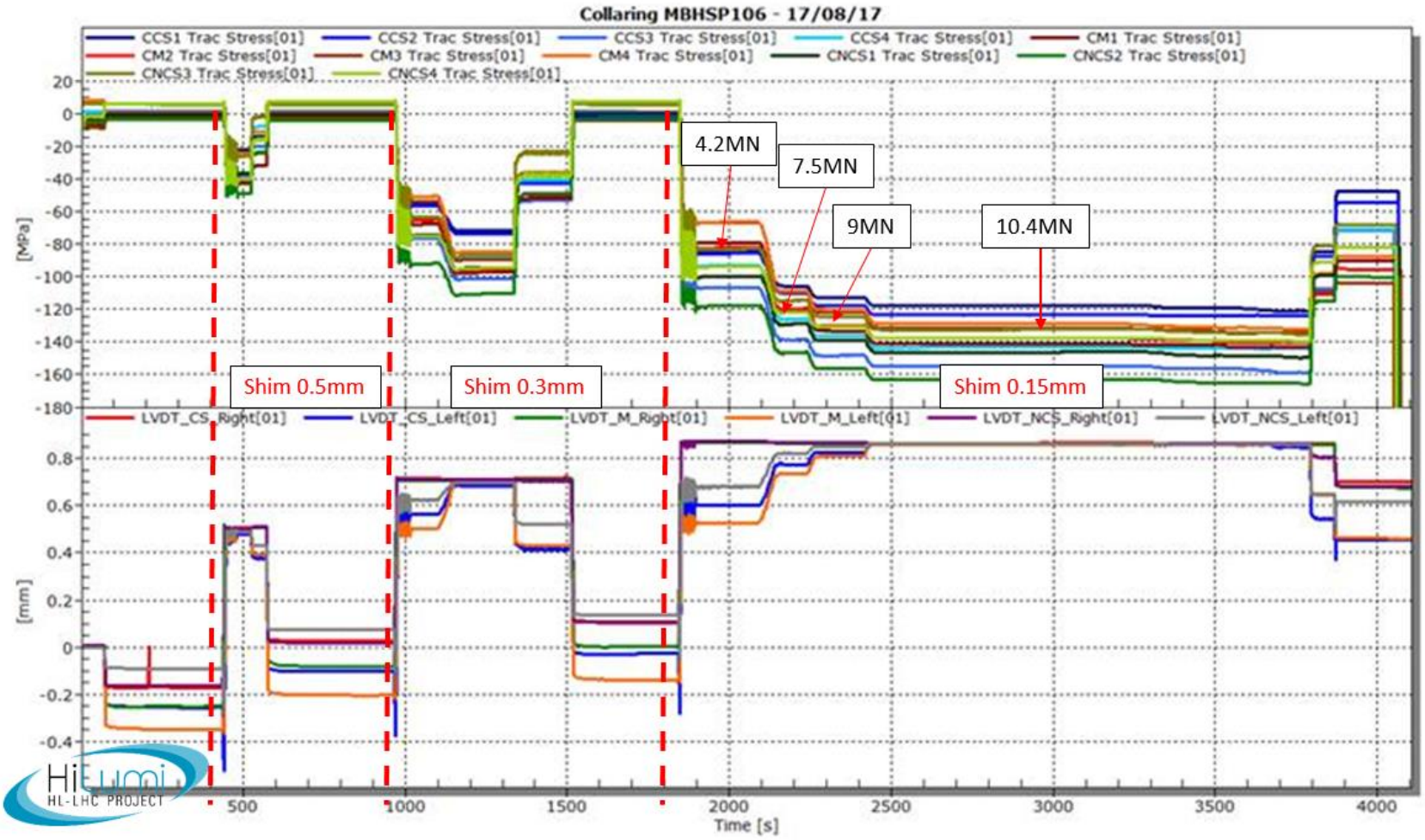
- **Decollaring:** shim 0.15 mm between stoppers (enough clearance for keys insertion) with 8 MN.

- **Decollaring:** above ≈ 10 MN (it depends on the coils size), the tooling is already closed and the extra force **could POSSIBLY be** share half and half between CC and Tooling.

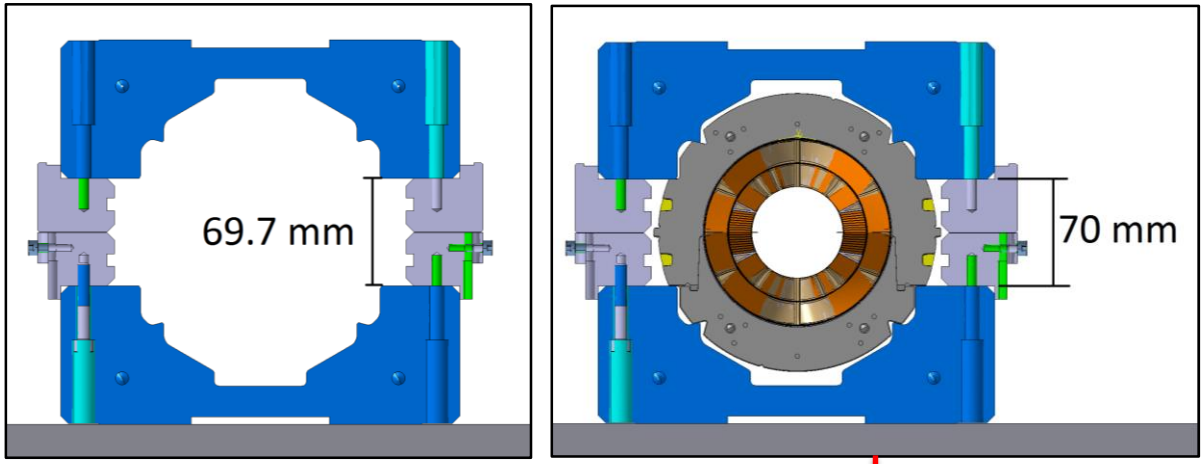
- Current state: electrical and geometrical measurements of the four coils 109, 112, 114 and 115.

THANKS FOR YOU ATTENTION

Extra slides



Extra slides



To insert the keys we need
70 – 0.15 = 69.85 mm