



Magnetic measurements on MCBRDS1b (D2 corrector)

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on behalf of MSC-MM

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Measurement goals

Characterization of the field in each aperture

- TF and multipoles as function of the current
- Independent powering, one aperture at a time
- Stair-step cycle preceded by a pre-cycle
- Up to nominal level, both polarities

Cross-talk between apertures (1)

- Both aperture powered at the same time
- Stair-step cycle in one aperture, DC current in the other
- Up to nominal level, both polarities

Cross-talk between apertures (2)

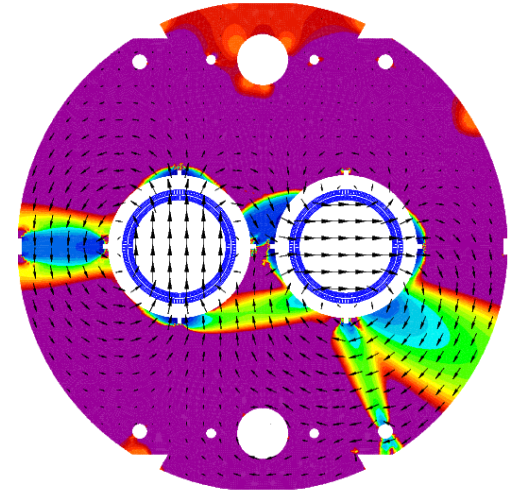
- Above nominal level but by powering one aperture at a time

Repeatability of field

- Repetition of a stair-step cycle in one aperture

Magnetization decay effects

- Long plateaus (1000 s) at different levels (nominal/4, nominal/2, nominal)
- Powering of one aperture



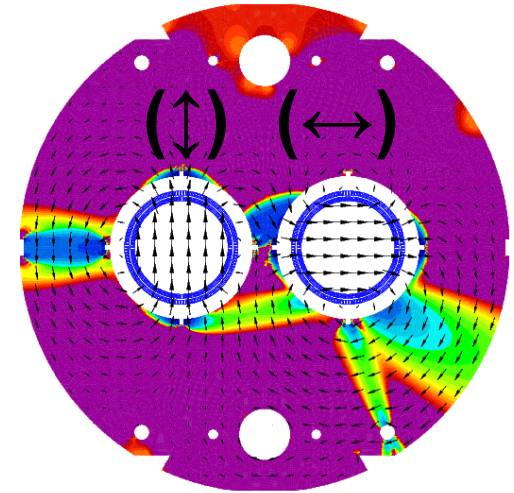
Measurement setup

Vertical station

- Two shafts in the helium bath
- Working in parallel

Shafts with different design

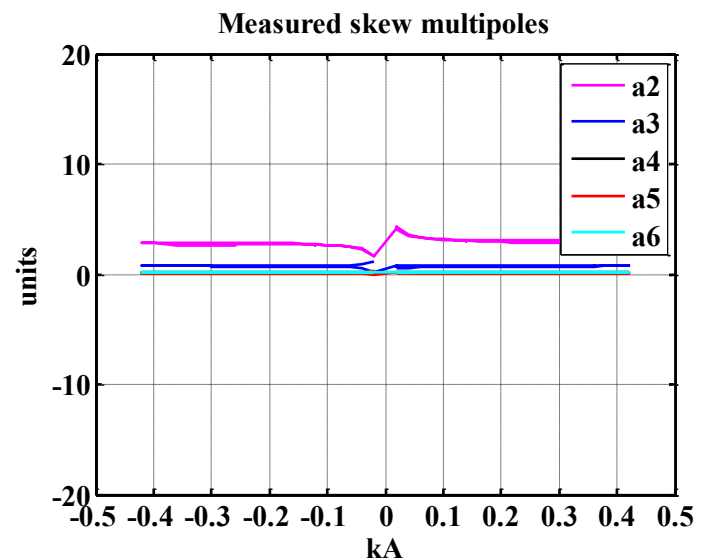
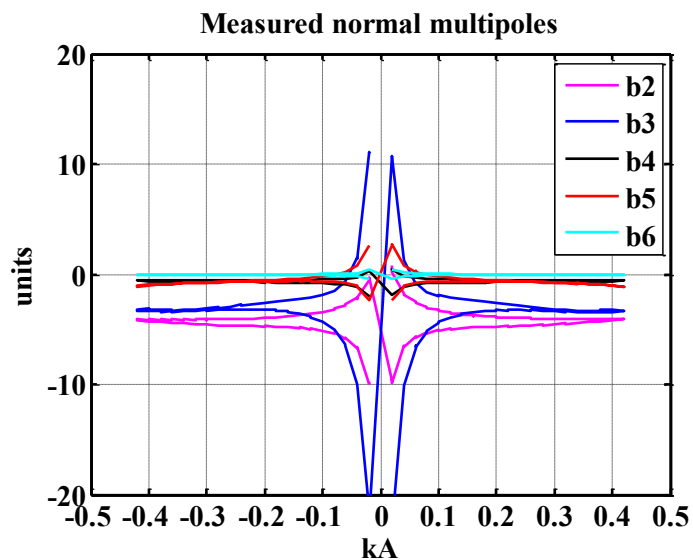
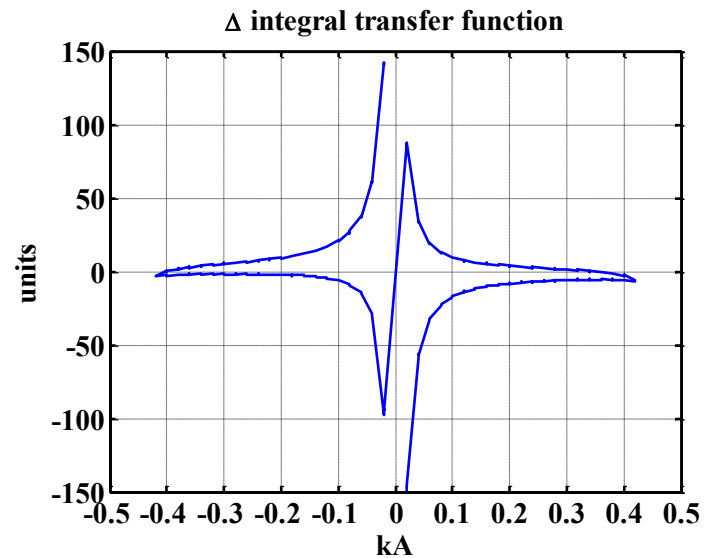
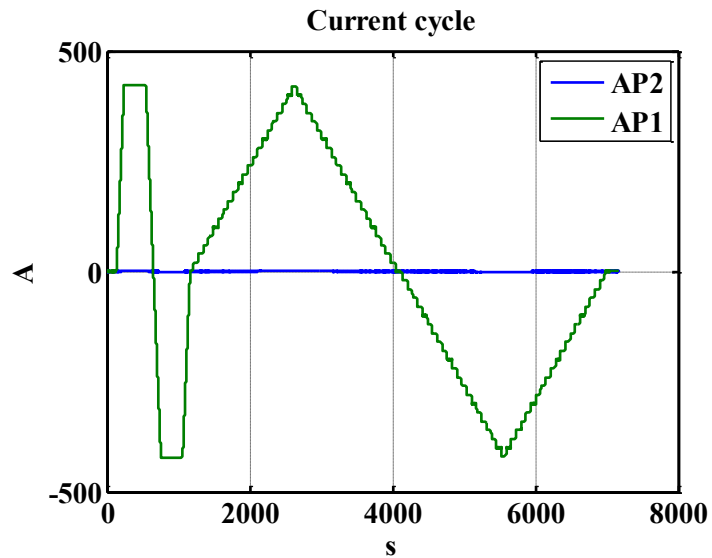
- The newest-built aperture (AP1) equipped with a G11 shaft and hand-wound coils
 - 5 segments connected in series (**integral field**)
 - Measurement length 1270 mm
 - Measurement radius 43 mm
- The first-built aperture (AP2) equipped with a new shaft made of a carbon-fiber shell and PCB coils
 - 1 segment (**integral field**)
 - Measurement length 1315 mm
 - Measurement radius 43 mm
- We could not measure the central field (2D)
 - Magnet is short and doesn't have a "straight section"



Reference radius is 35 mm

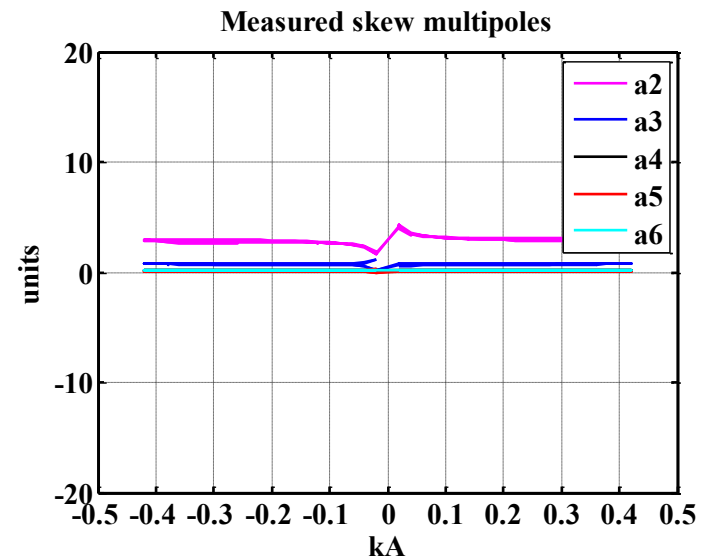
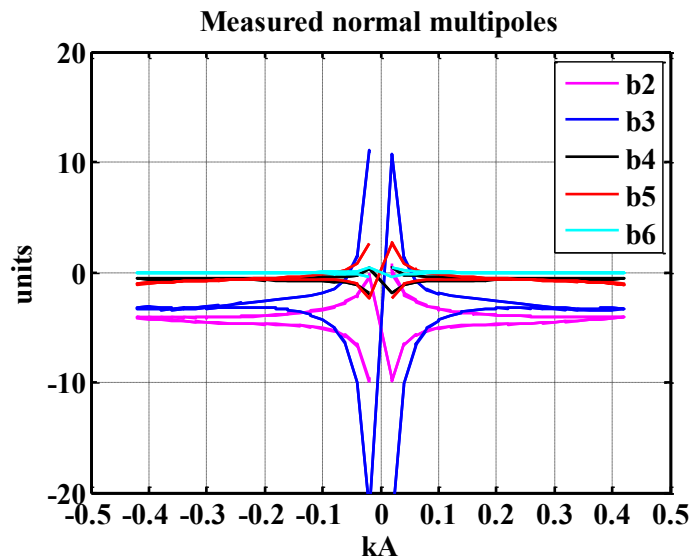
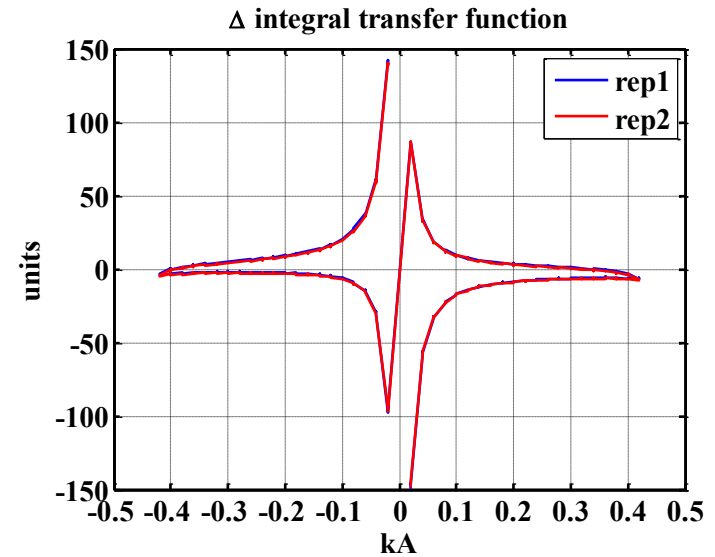
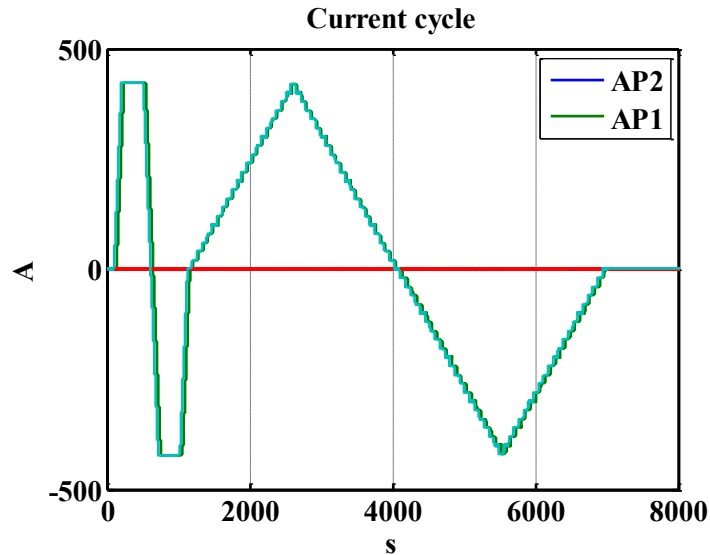
AP1 newest built (\updownarrow)

$$TF = 1.696 \text{ Tm kA}^{-1}$$



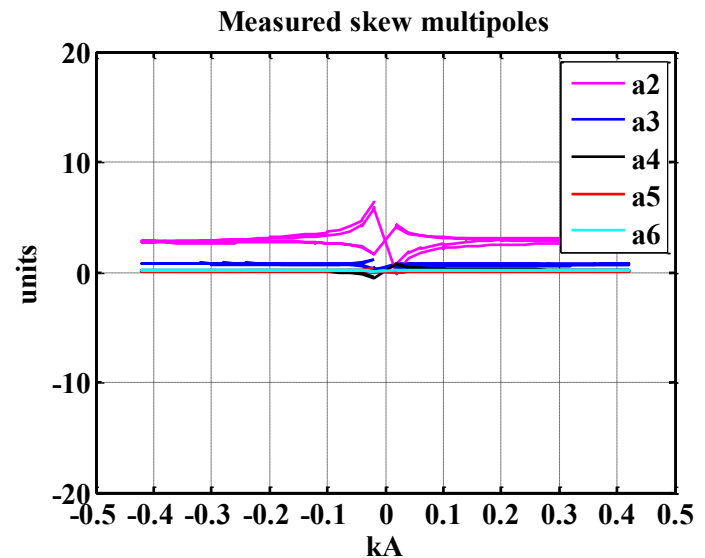
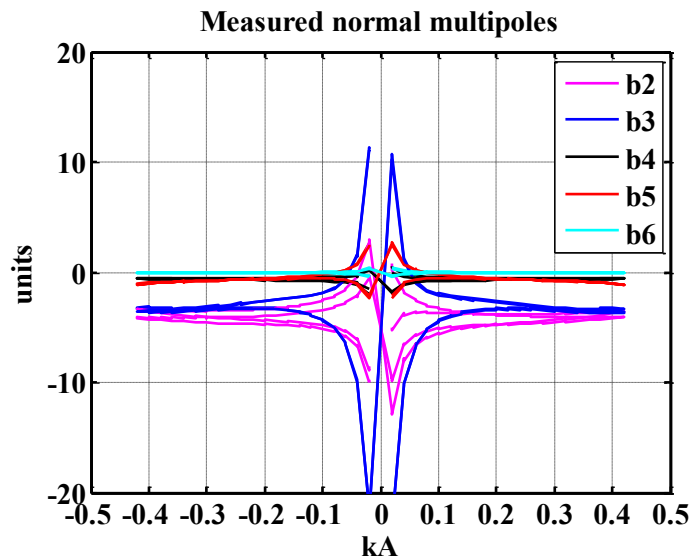
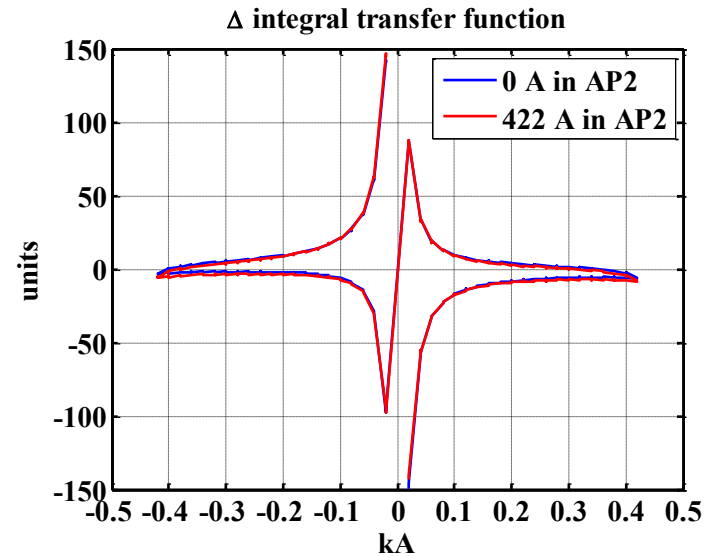
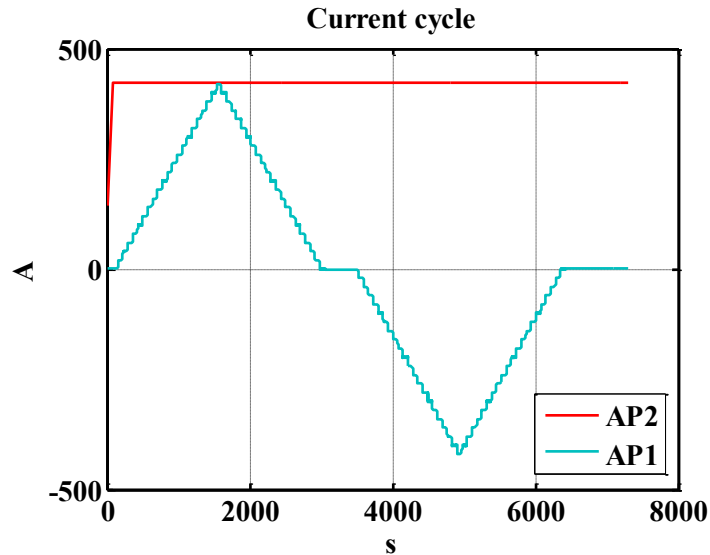
AP1 newest built (\updownarrow) Repeat.

TF = 1.696 Tm kA⁻¹

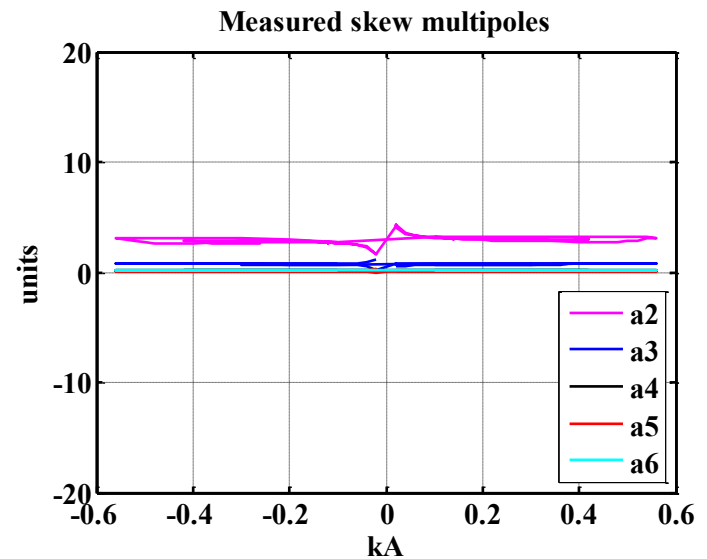
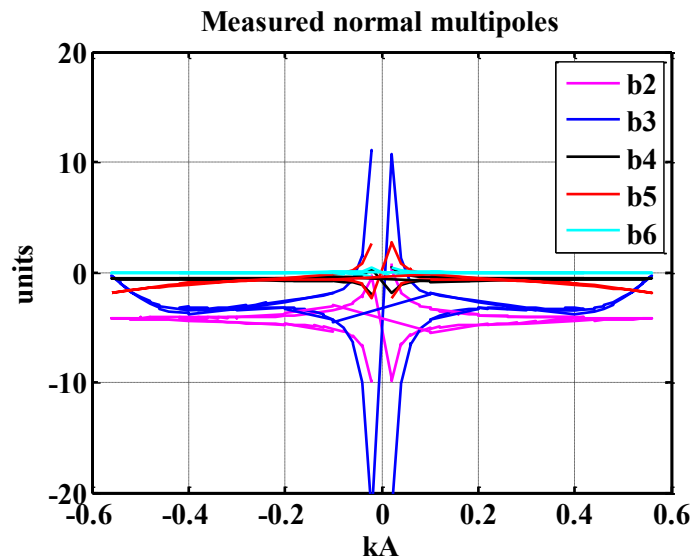
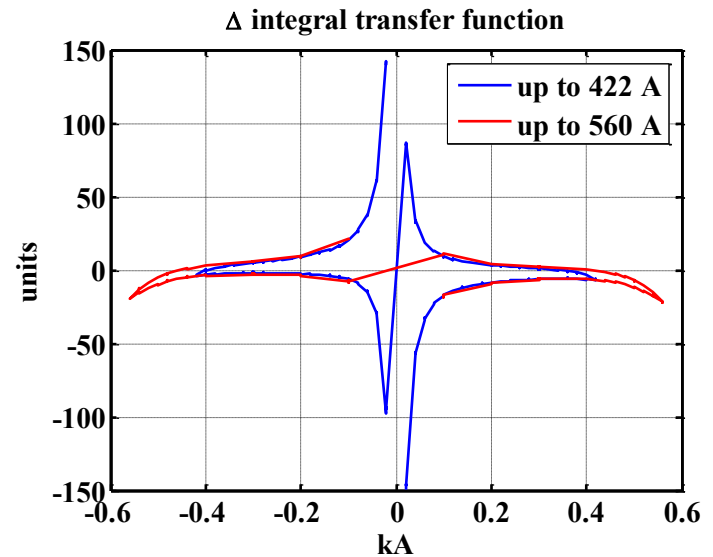
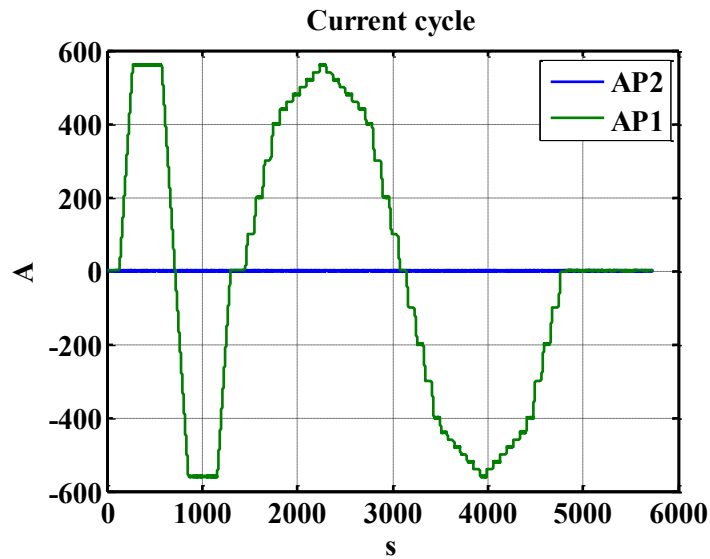


AP1 newest built (\updownarrow) X-talk

$$TF = 1.696 \text{ Tm kA}^{-1}$$

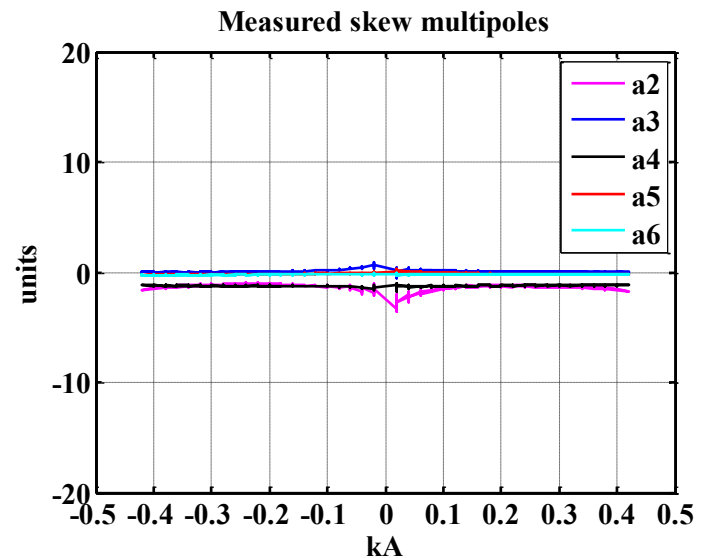
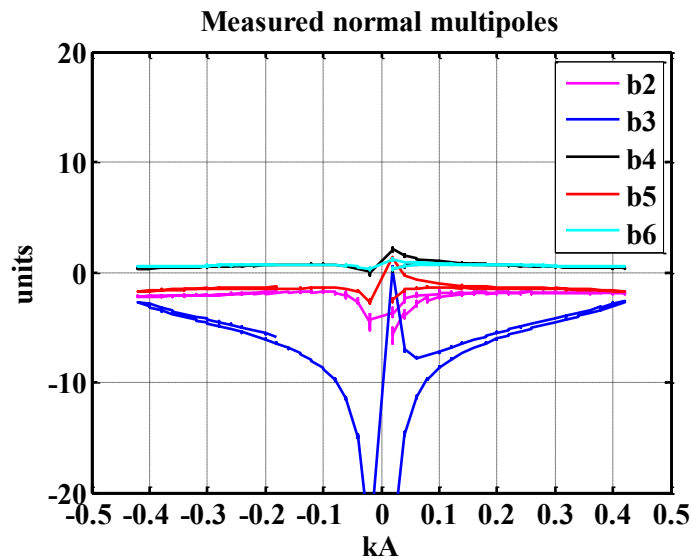
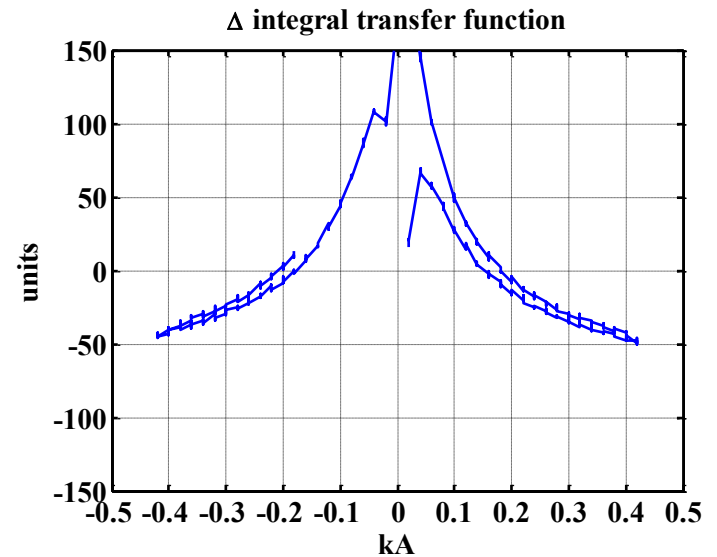
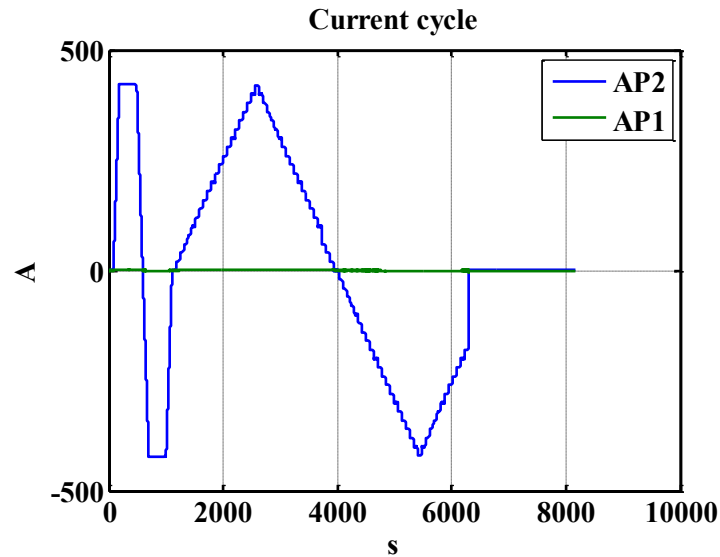


AP1 newest built (\updownarrow) Above nom. TF = 1.696 Tm kA⁻¹



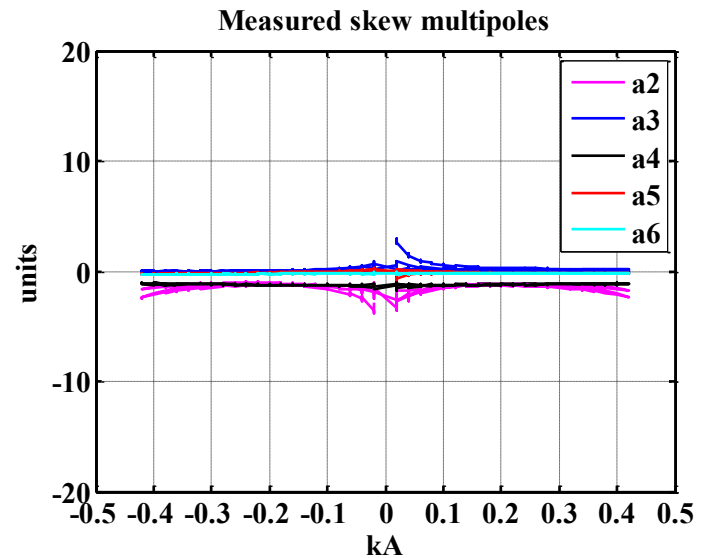
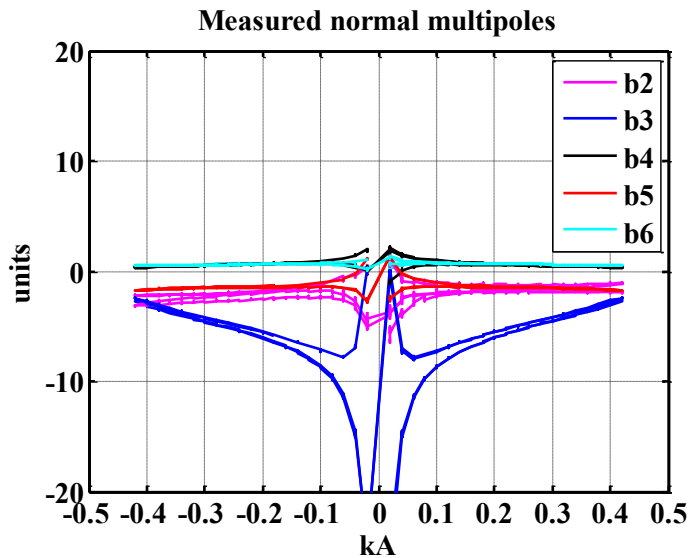
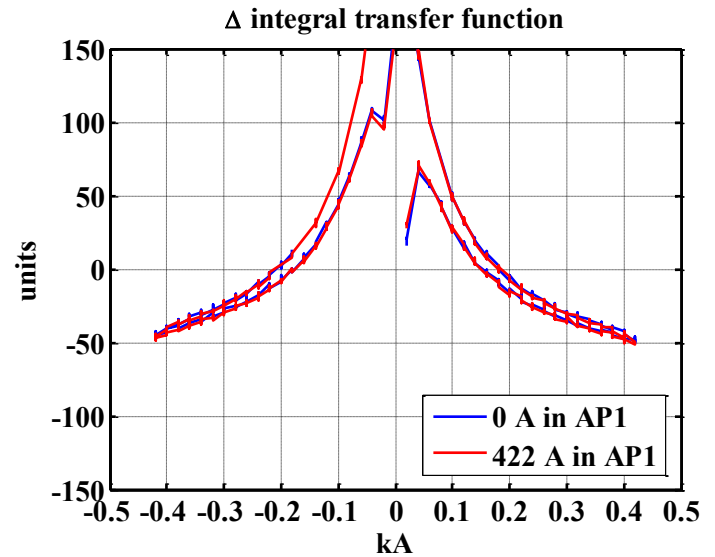
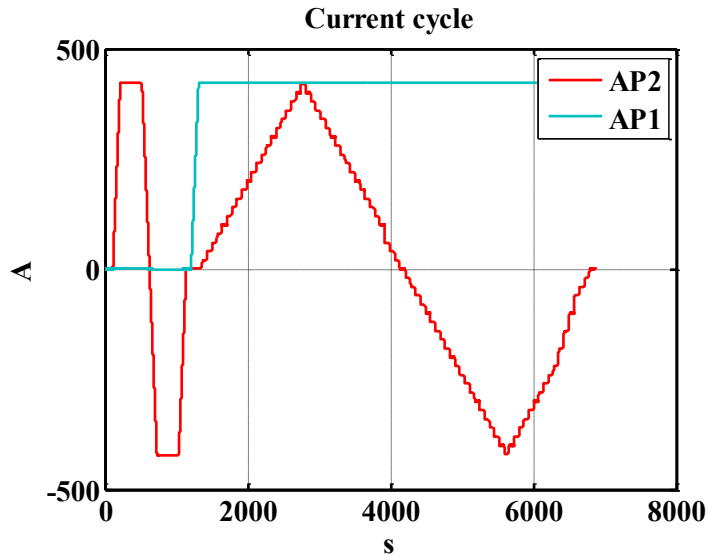
AP2 first built (\leftrightarrow)

$$TF = 1.699 \text{ Tm kA}^{-1}$$



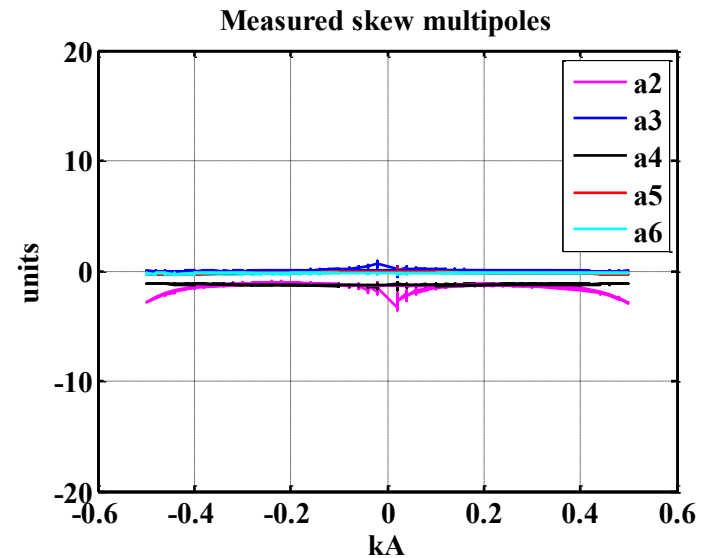
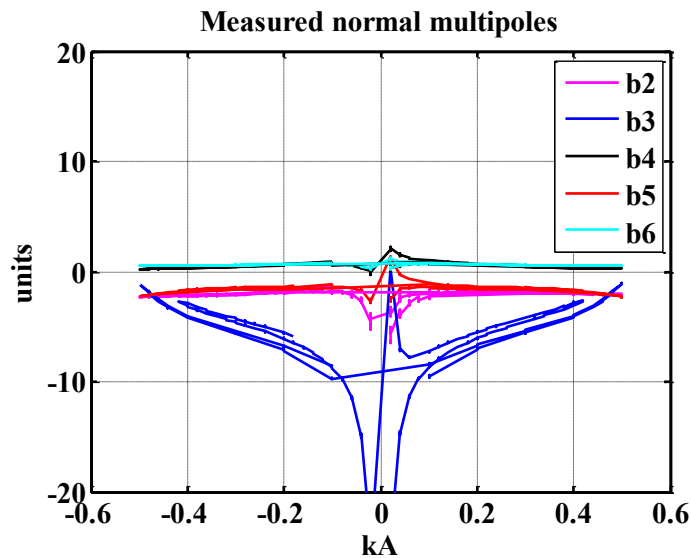
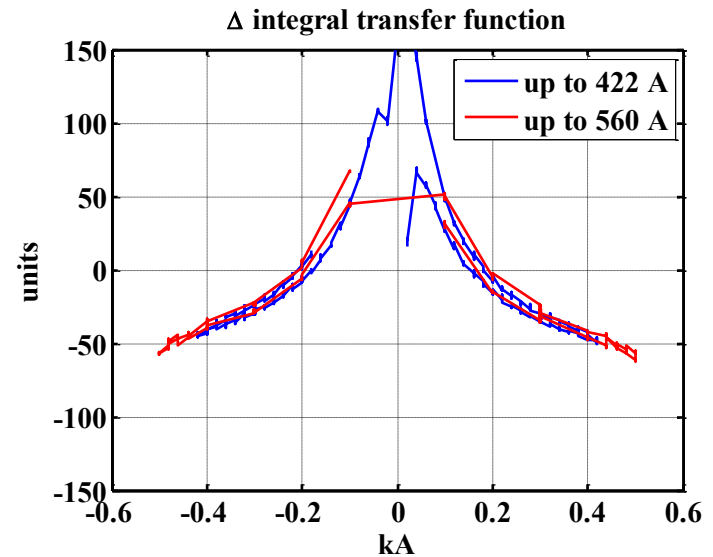
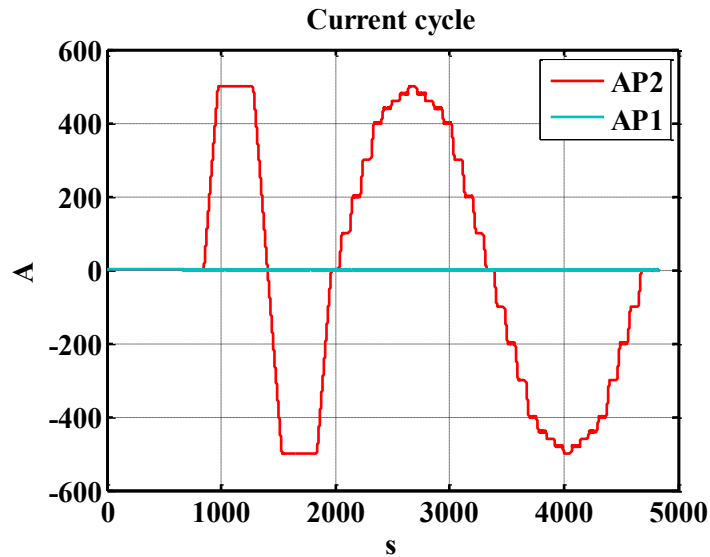
AP2 first built (\leftrightarrow) X-talk

$$TF = 1.699 \text{ Tm kA}^{-1}$$



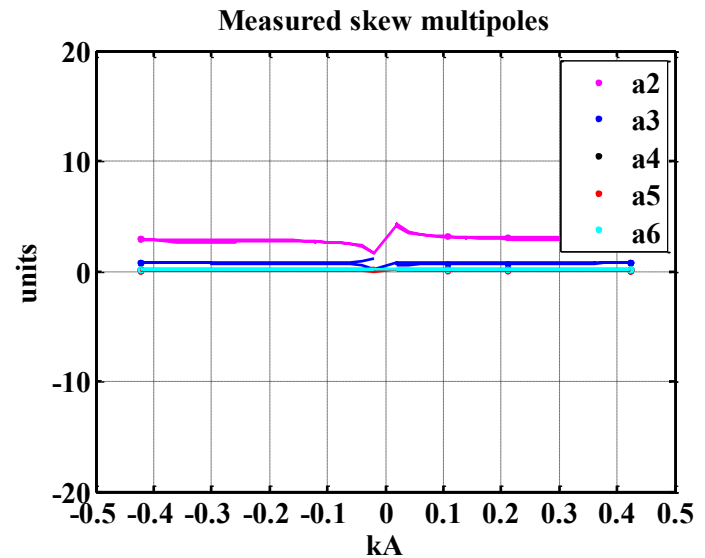
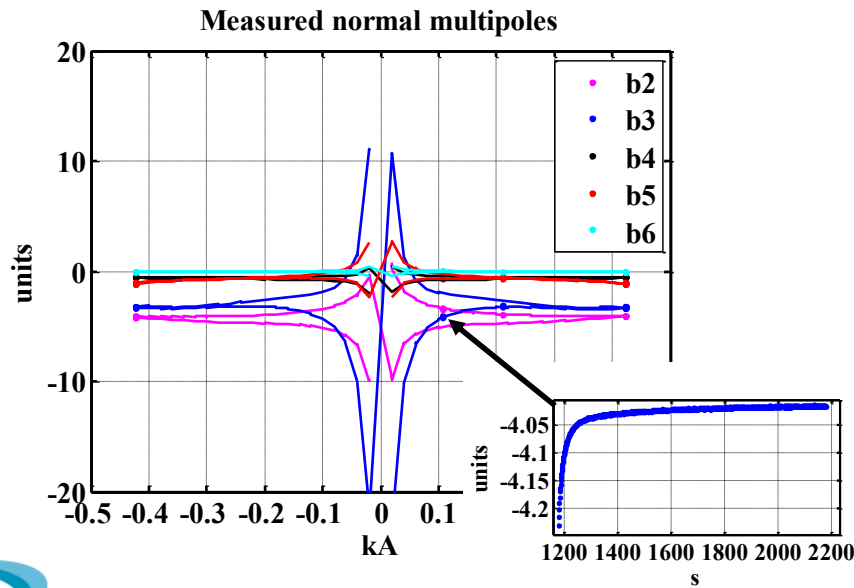
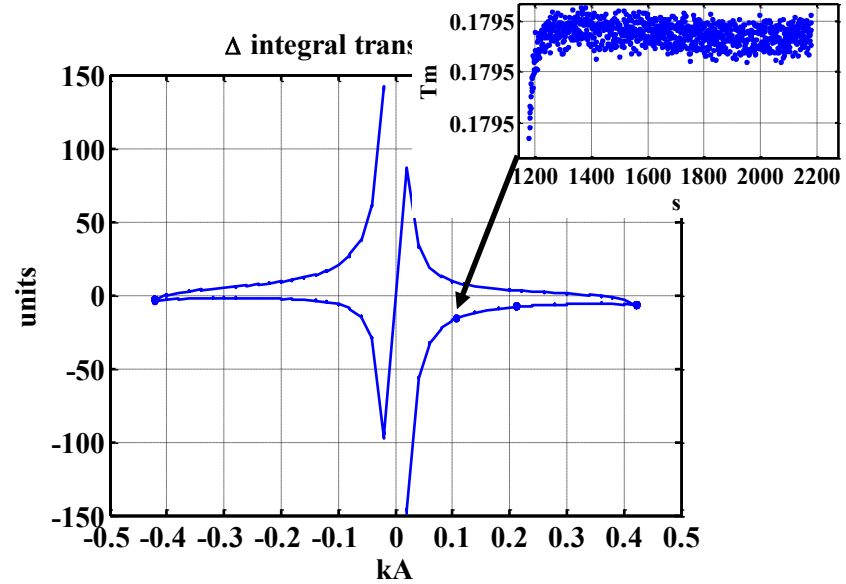
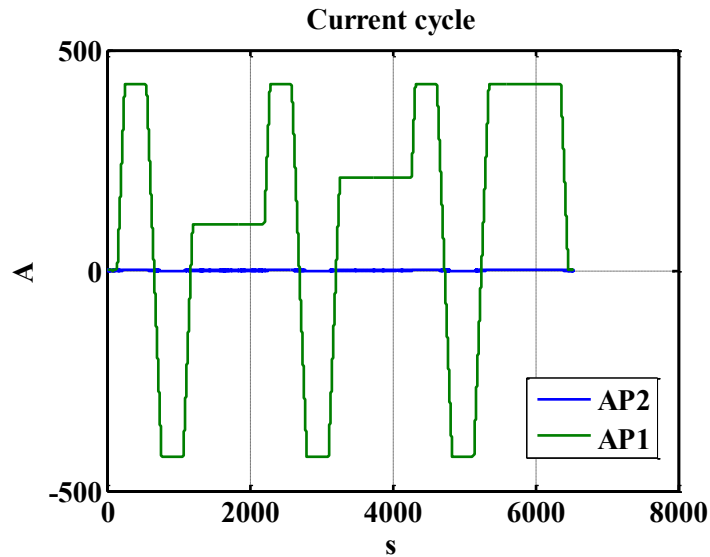
AP2 first built (\leftrightarrow) Above nom.

TF = 1.699 Tm kA⁻¹



AP1 newest built (\updownarrow) Long plts

TF = 1.696 Tm kA⁻¹



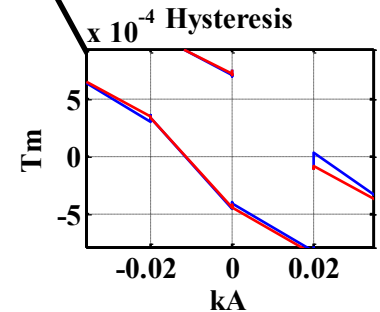
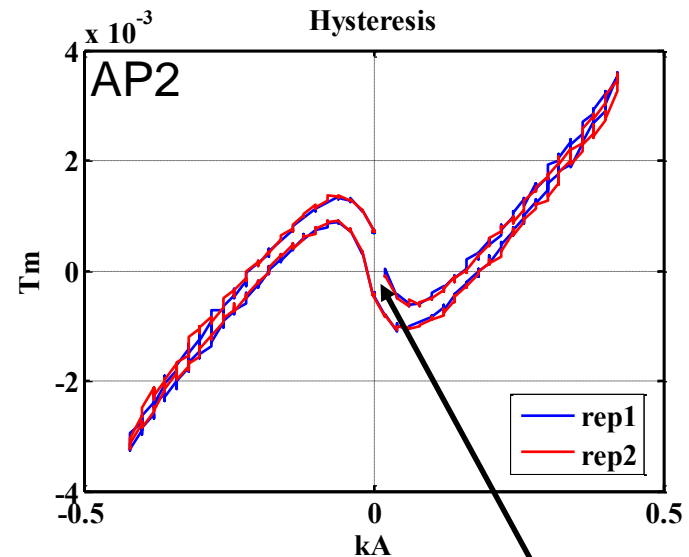
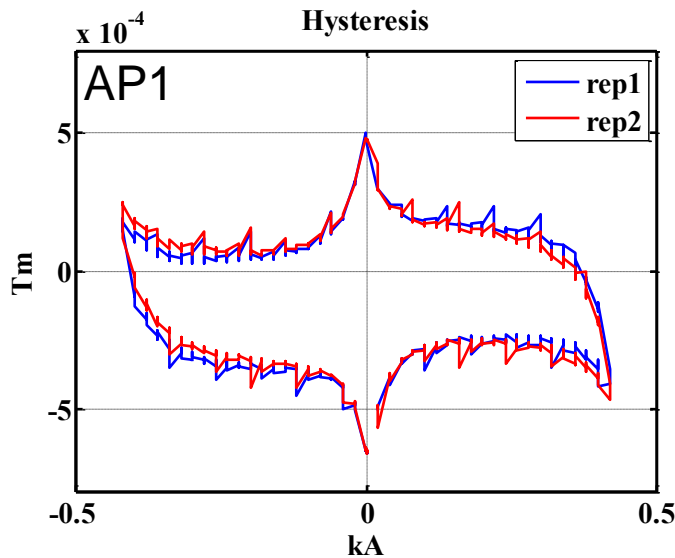
Summary tables

AP1 vertical field newest-built aperture			
TF			
1.695			T m kA ⁻¹
n	bn	an	
2	-4.10	-2.97	units at 35 mm
3	-3.29	-0.74	
4	-0.59	-0.16	
5	-1.09	-0.08	
6	-0.05	-0.16	
7	-0.09	-0.14	
8	0.01	-0.05	
9	-0.06	-0.03	
10	-0.03	-0.02	
at nominal field level and 1.9 K			

AP2 horizontal field first-built aperture			
TF			
1.698			T m kA ⁻¹
n	bn	an	
2	-2.05	1.70	units at 35 mm
3	-2.69	-0.01	
4	0.35	1.17	
5	-1.77	0.23	
6	0.54	0.23	
7	0.28	0.09	
8	0.28	0.05	
9	0.01	0.05	
10	0.07	0.01	
at nominal field level and 1.9 K			

Hysteresis and remanence

Residuals from linear fit of main field vs current



- Hysteresis and remanence are within ± 0.5 mT m
- ~ 7 units of the field at nominal (0.72 Tm)

Conclusions

- Field quality within specs (<10 units) on both apertures
 - Offset on b3 could be related to the limited length of the magnet
 - The two ends should be symmetric and compensating on the integral but if the magnet is too short there is something missing...
- Saturation and cross-talk smaller than expected
 - No saturation at nominal level
 - Saturation stays small even well above nominal level
 - To be investigated (3D effect?)
- A non-linearity on the TF and b3 of the aperture with horizontal field is visible
 - Local saturation effect (key slots?)
- Remanence on main field < 10 units of nominal level
- Main field repeatability at 1 unit level (same cycle)
- Magnetization-decay effects within 1 unit