Flux jumps signals in magnetic probes

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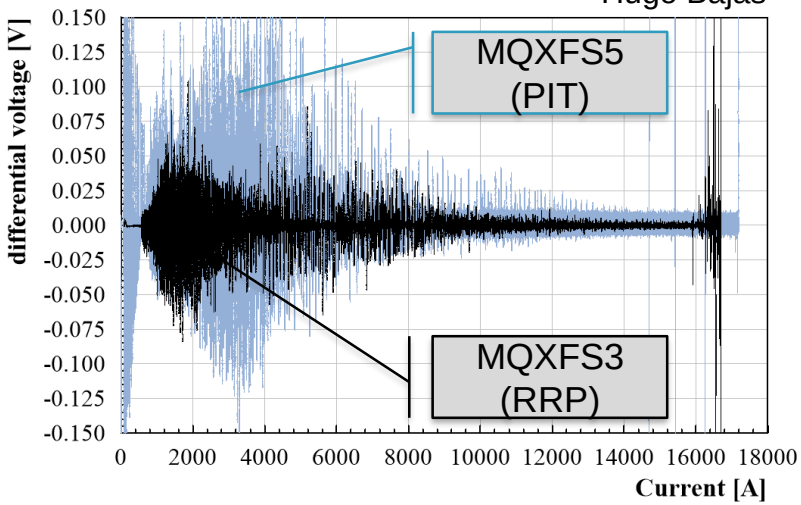
WP3, WP2, WP6b meeting, 16/05/2018

Flux jumps and MM

Hugo Bajas



Flux jumps

- are fast events (>> 1 Hz)
- occur during ramps
- mainly at low/intermediate field

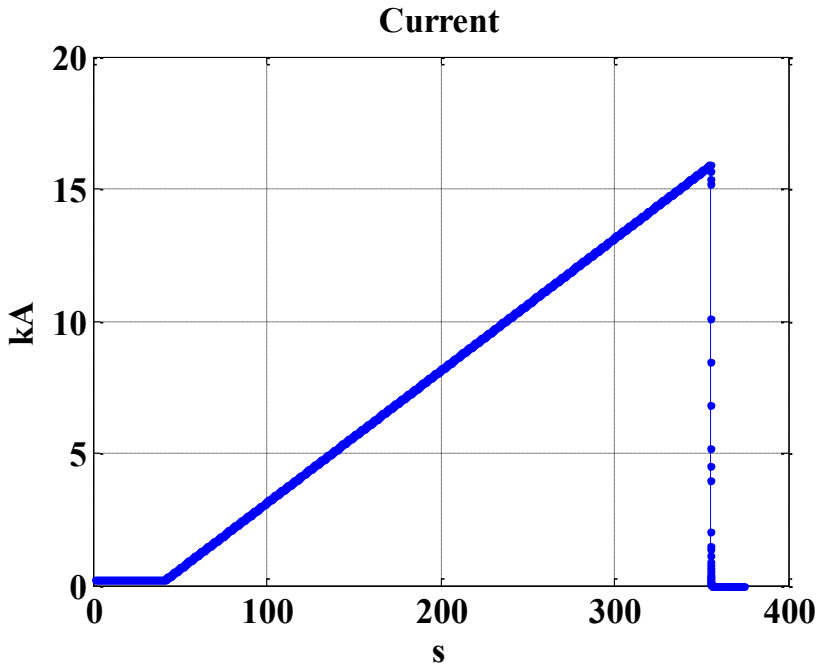
Standard magnetic measurements based on rotating coils

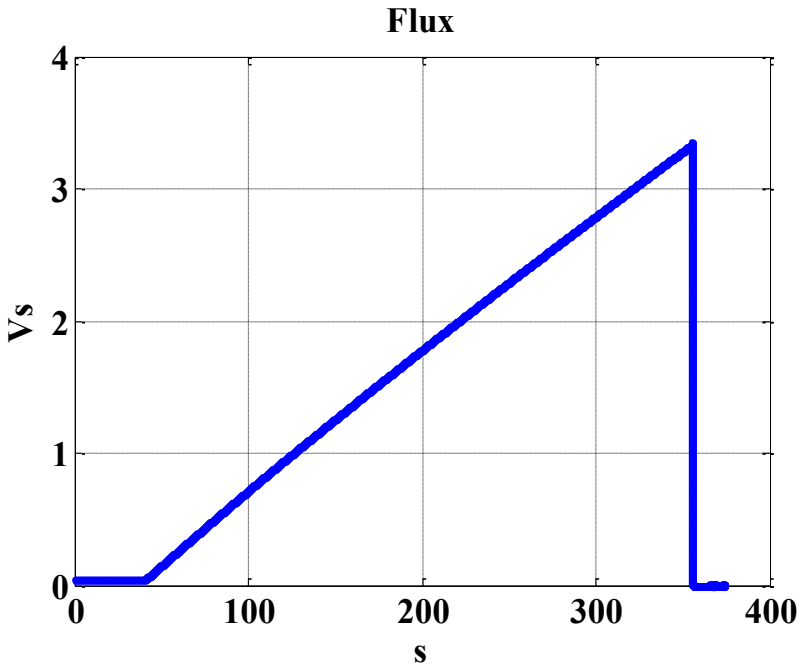
- provide absolute field and harmonics
- are very precise
- but have limited bandwidth (~ 1 Hz)

Fixed coils (fluxmeters)

- have larger bandwidth (~1 kHz)
- relative measurement (change of main field)
- less precise (integration drift)

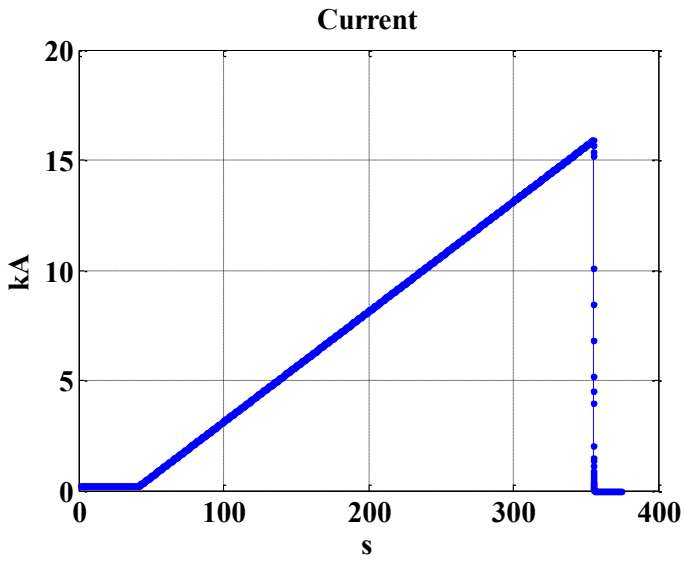
MQXFS3c measured with a fixed coil



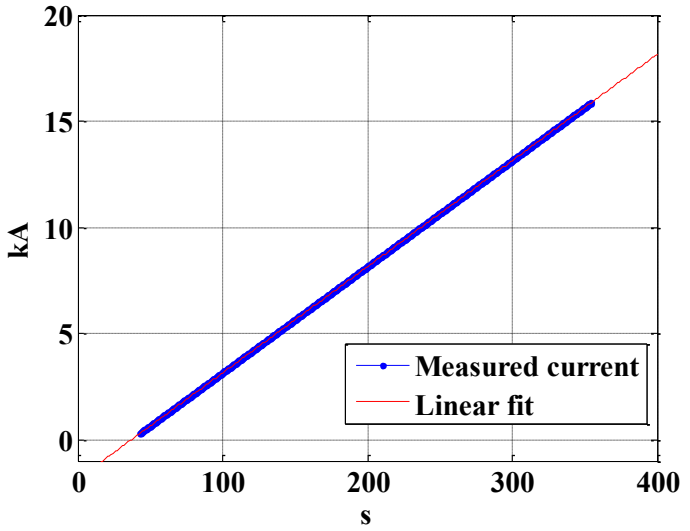


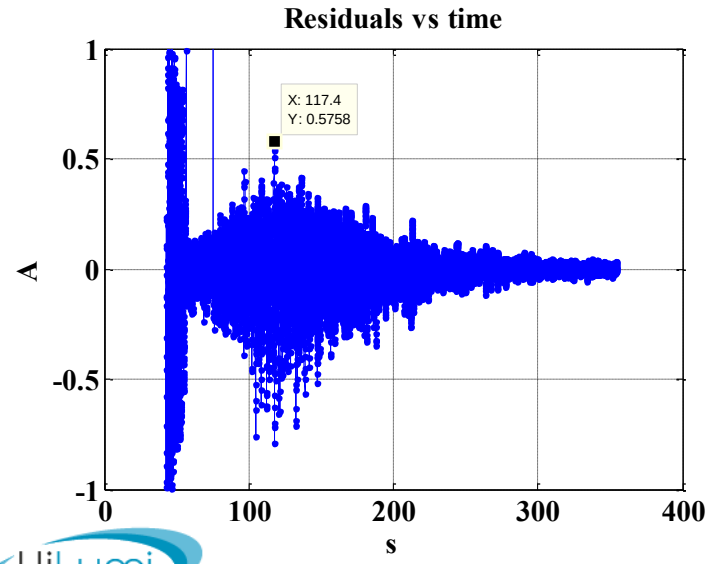
- Ramp at 50 A/s followed by a CLIQ discharge
- Current measured at 50 Hz (given by the FGC)
- Flux measured at 7.5 kHz (maximum frequency of MM system)

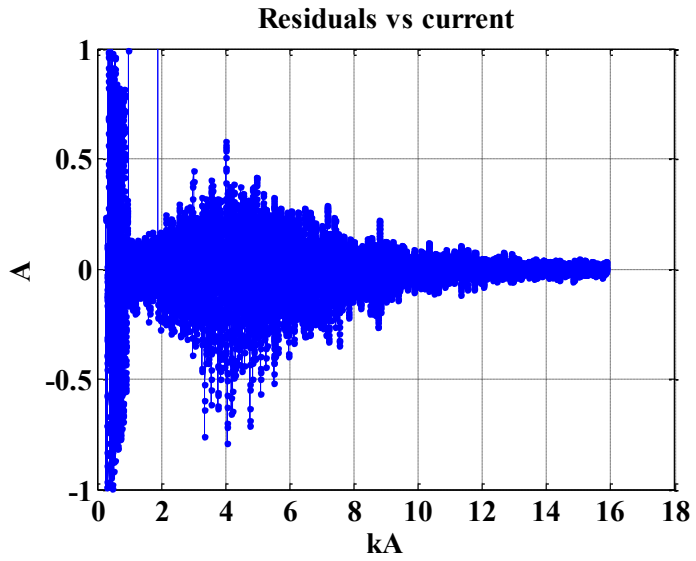
Analysis of the current



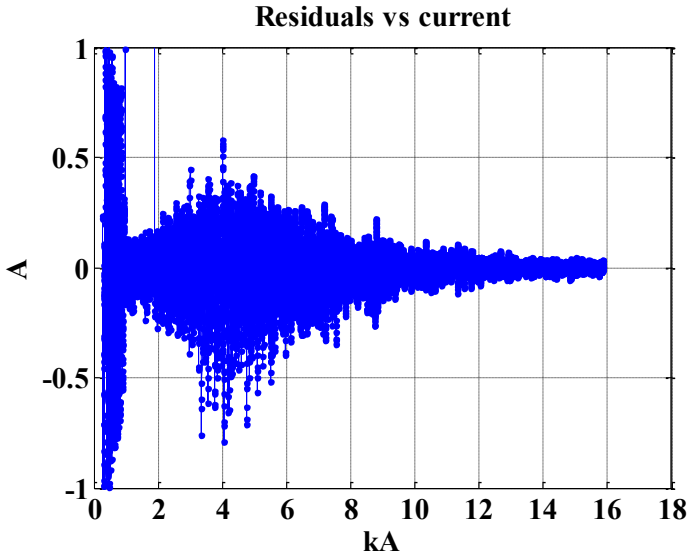
Selection of linear part

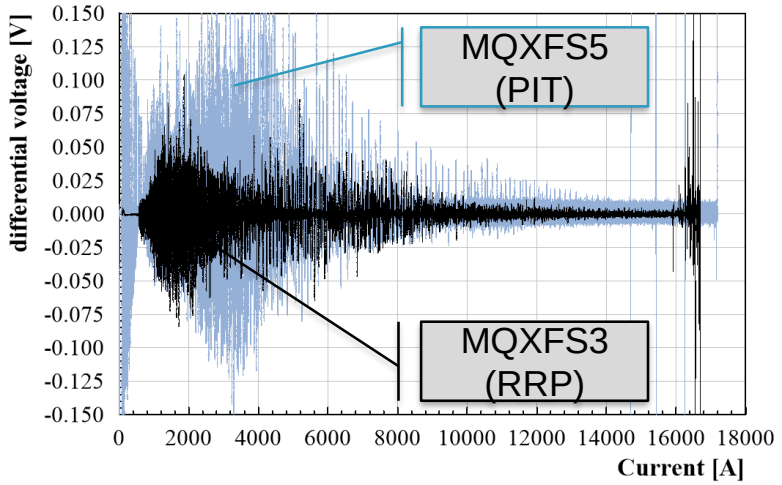


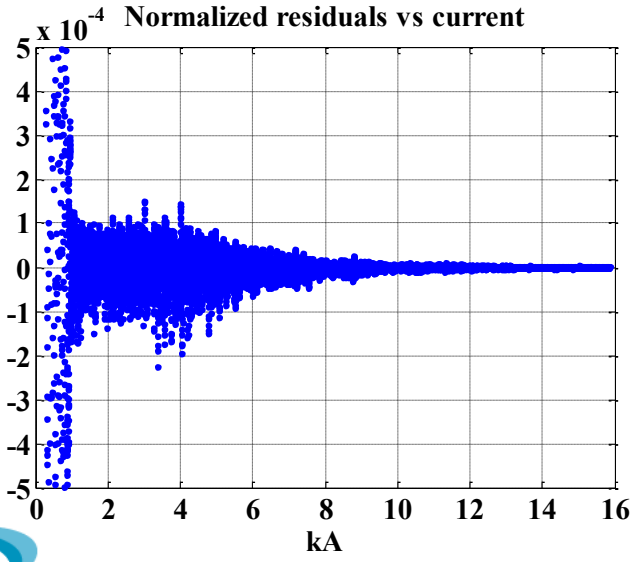




Analysis of the current



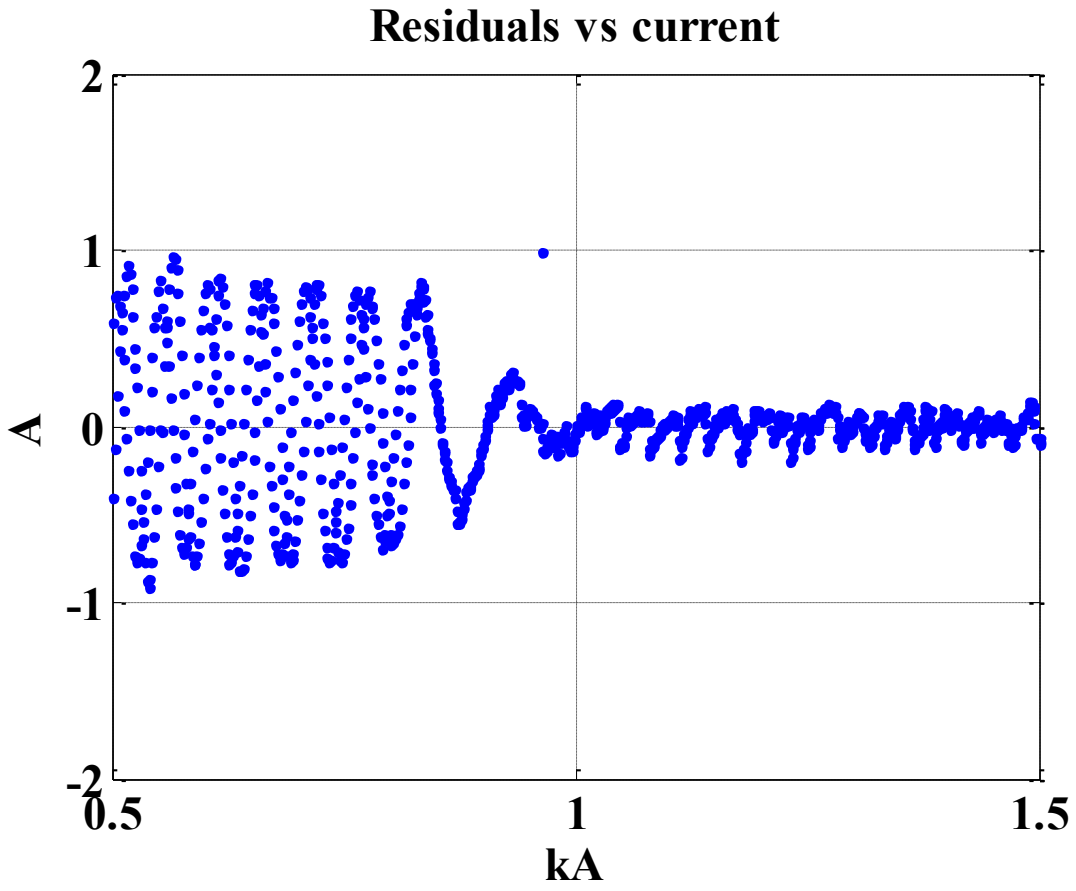




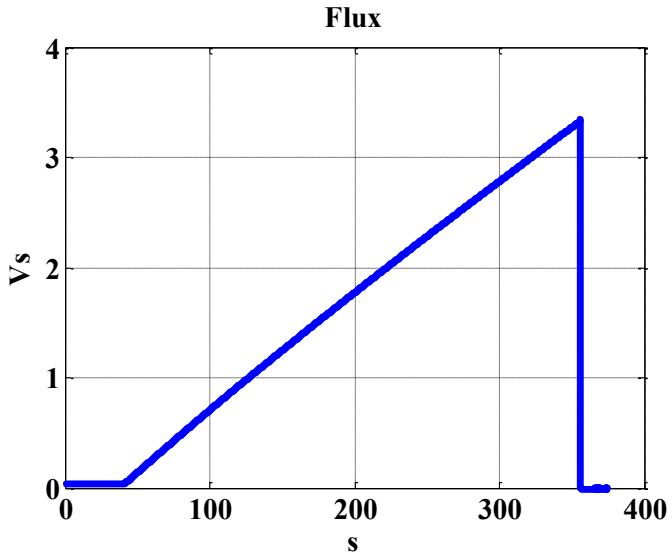
We see a “noise” on the measured current

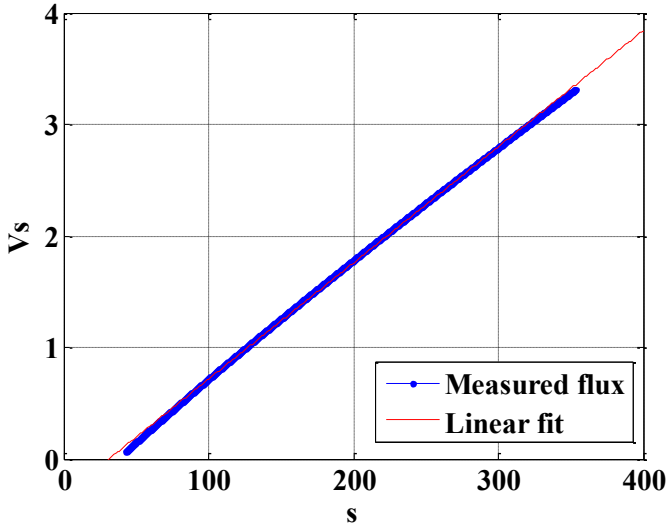
- with amplitude ~1*10^{-4}
- can be related to the flux jumps measured on the voltage

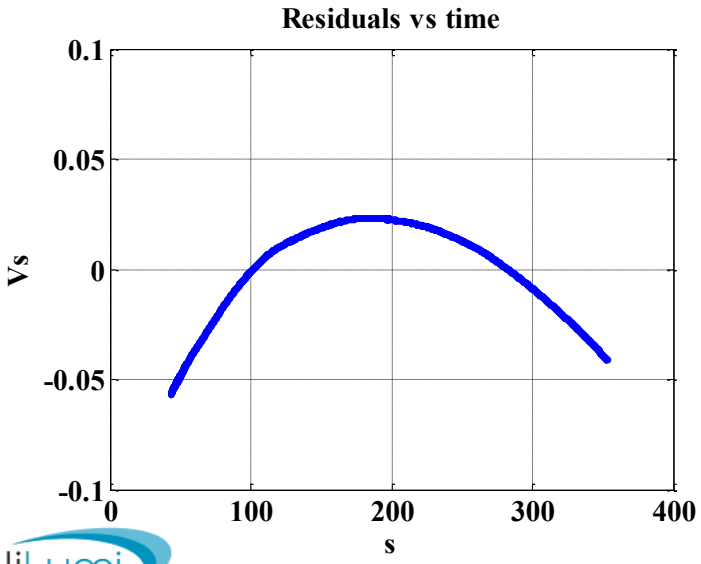
Noise on current around injection



Analysis of the flux



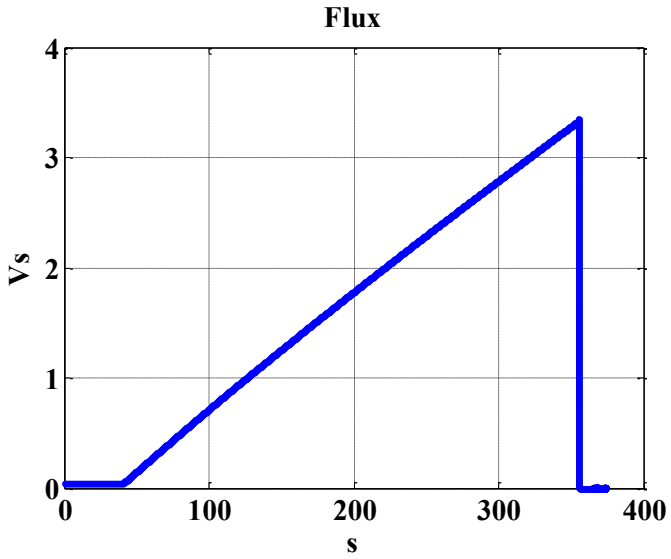




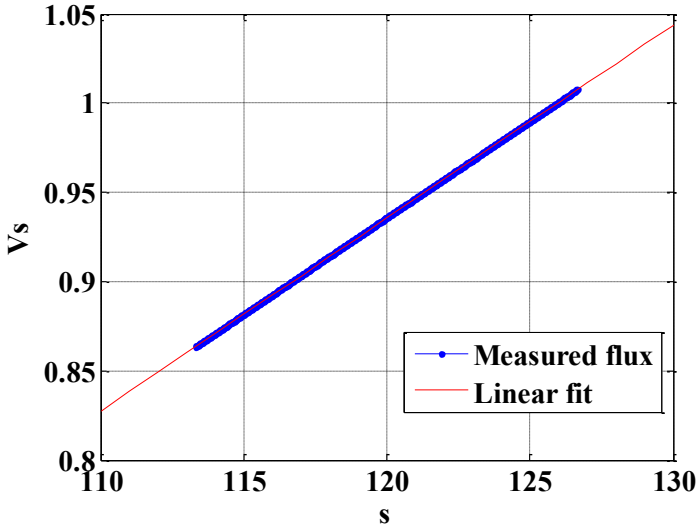
We only see the non-linearity of the magnet due to the saturation of the iron yoke

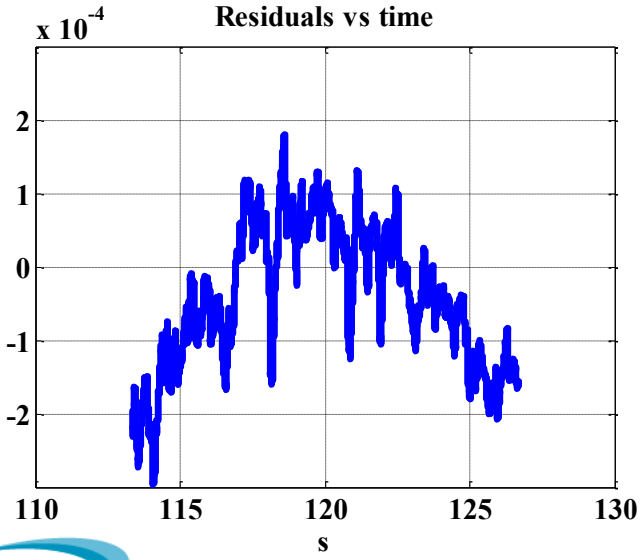
HiLumi HL-LHC PROJECT

Analysis of the flux



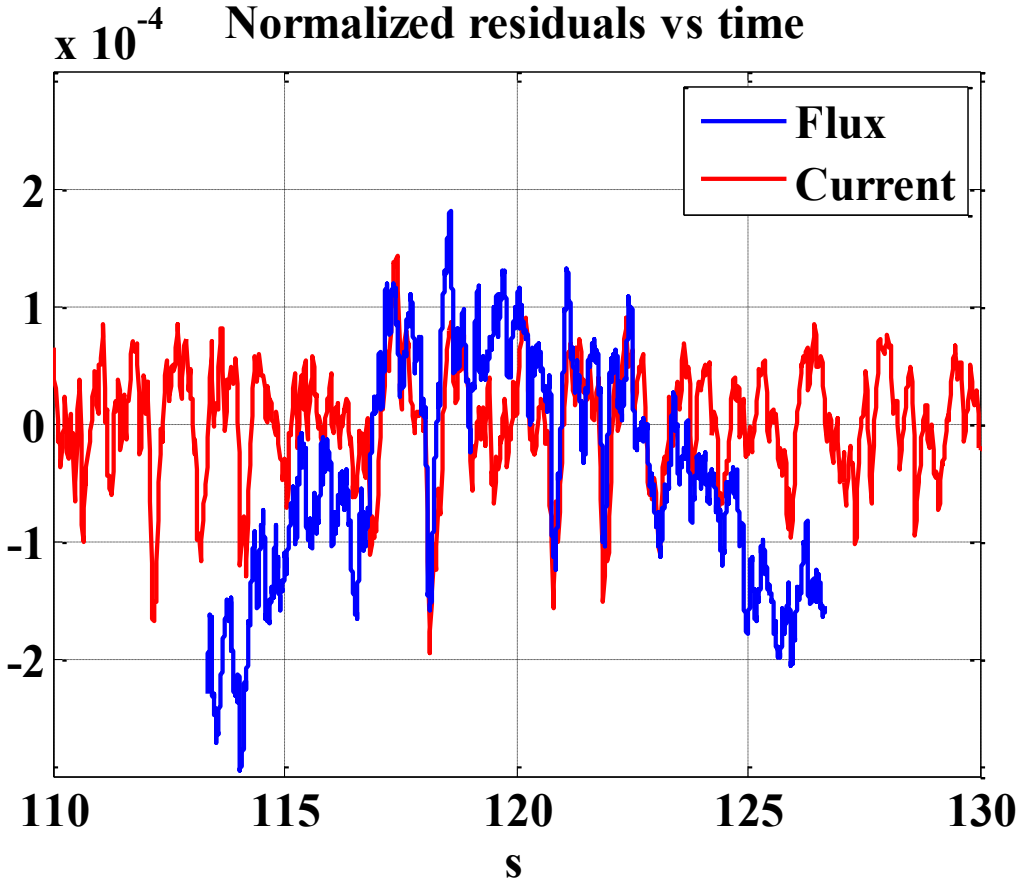
Selection of a smaller range





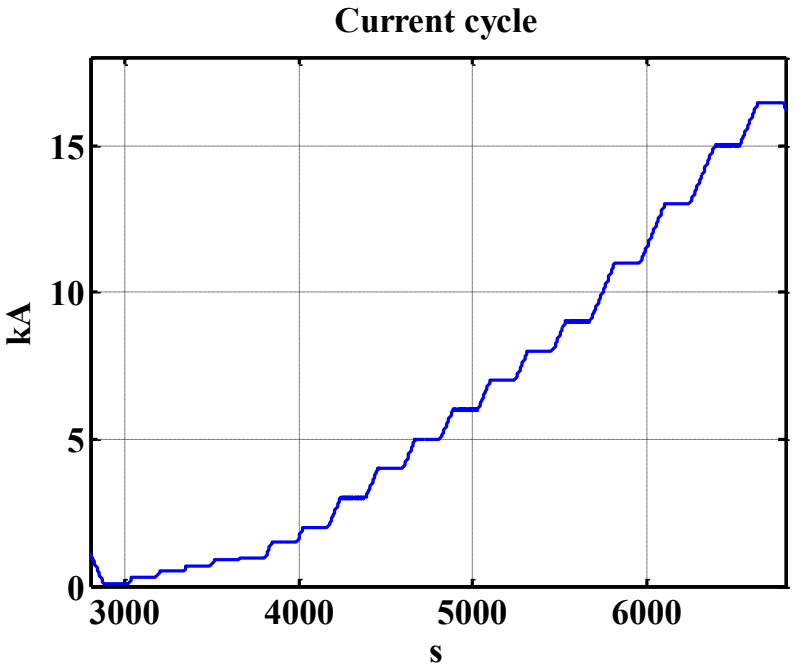
We see the “noise” and a residual non-linearity

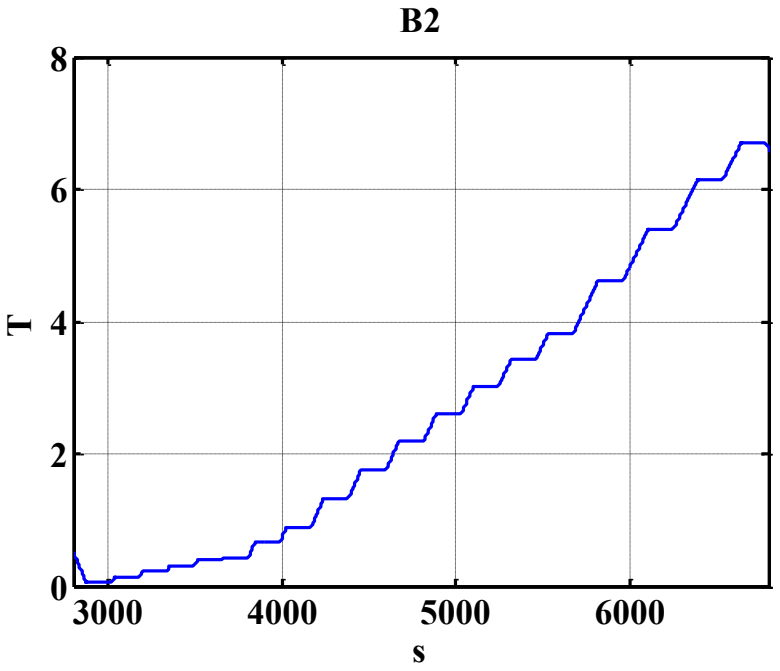
Comparison of measured noise on current/flux



During a ramp, in the field range where the flux jumps have maximum amplitude, we measure a “noise” with amplitude ~$1*10^{-4}$ on both current and field.

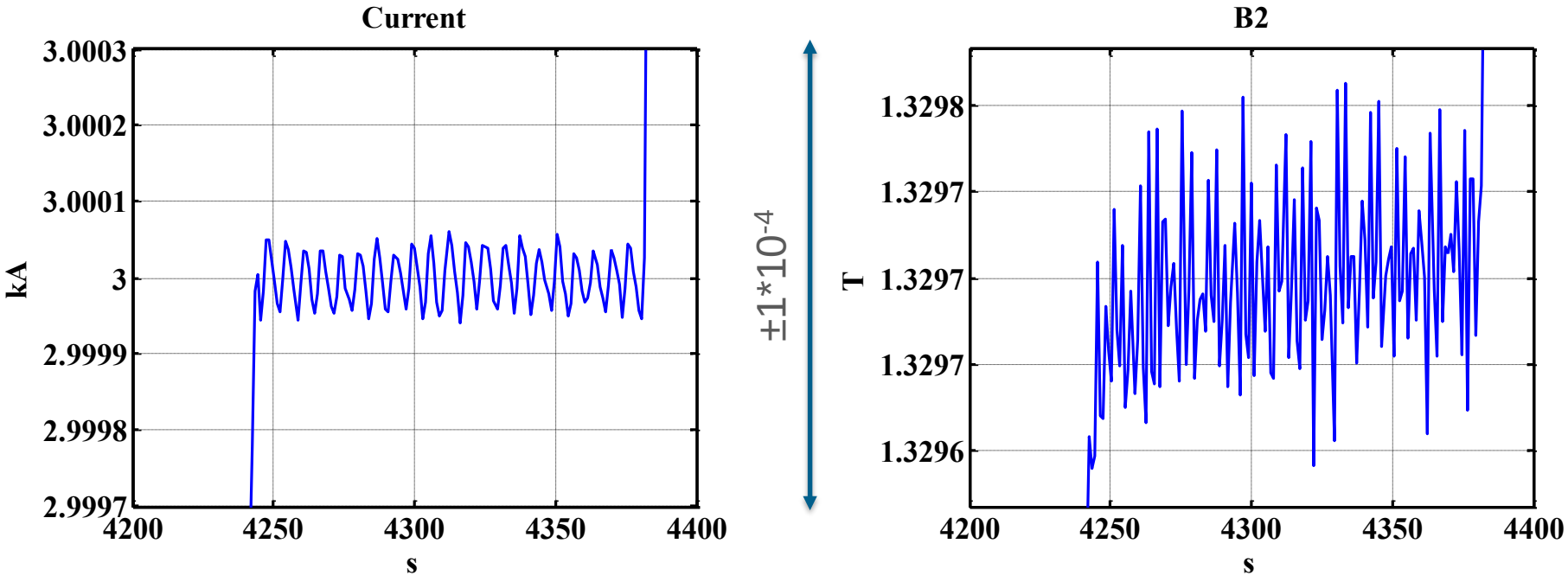
MQXFS5 measured with rotating coils





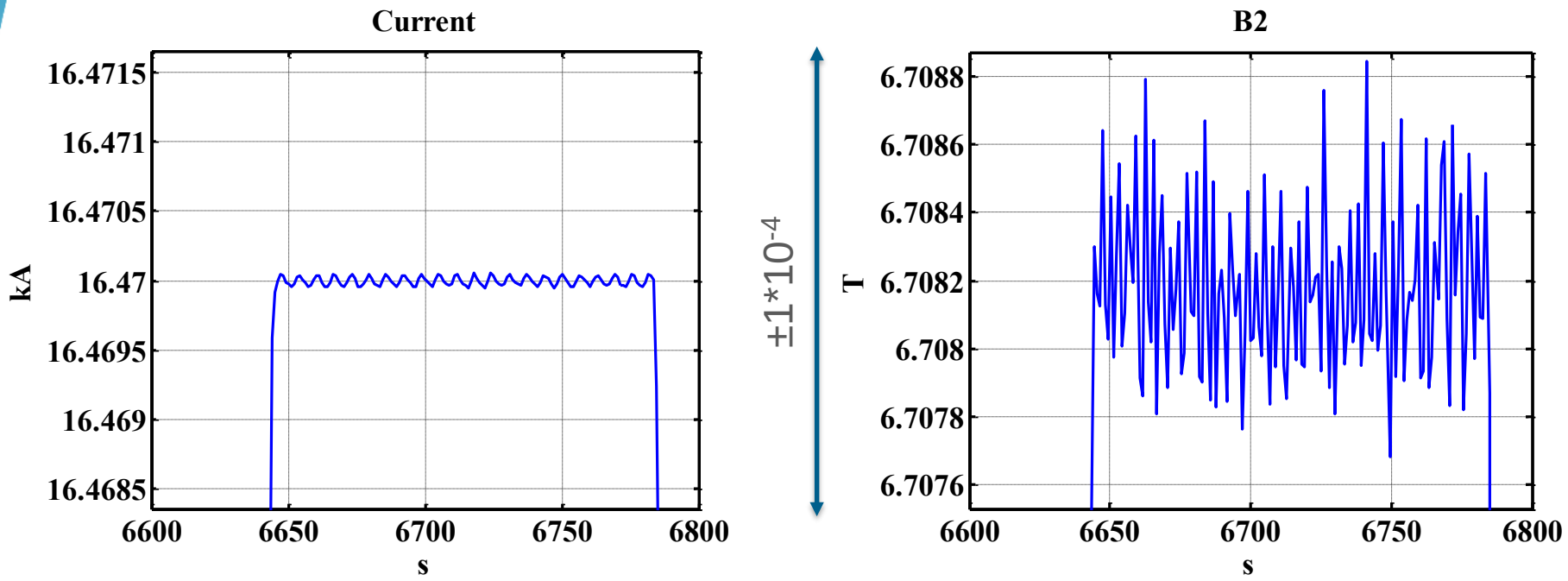
- Sequence of ramps (at 15 A/s) and plateaus (120 s)
- Current measured at 1 Hz (down sampling of the FGC data)
- Field measured at 1 Hz (rotation frequency of the rotating coil)

At low field



During a plateau, in the field range where the flux jumps have maximum amplitude, we measure a noise on the field with amplitude $<1*10^{-4}$ (~measurement precision).

At high field



During a plateau at nominal field, we measure a noise on the field with amplitude $<1*10^{-4}$ (~measurement precision).