

MD#4147

50Hz harmonics perturbation

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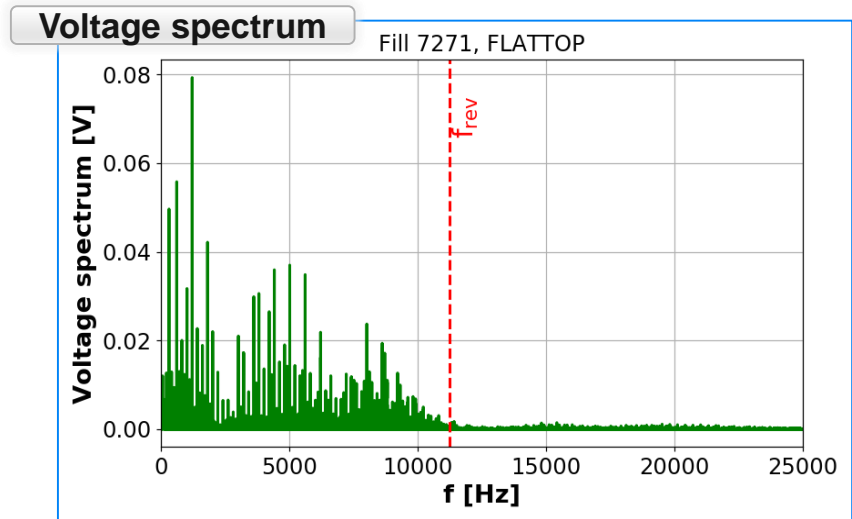
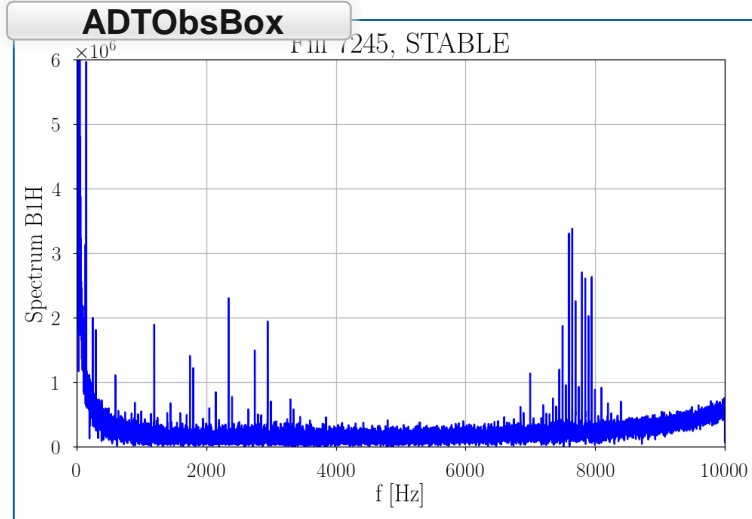
On behalf of the “50Hz noise” MD team

rMPP, 18.10.2018



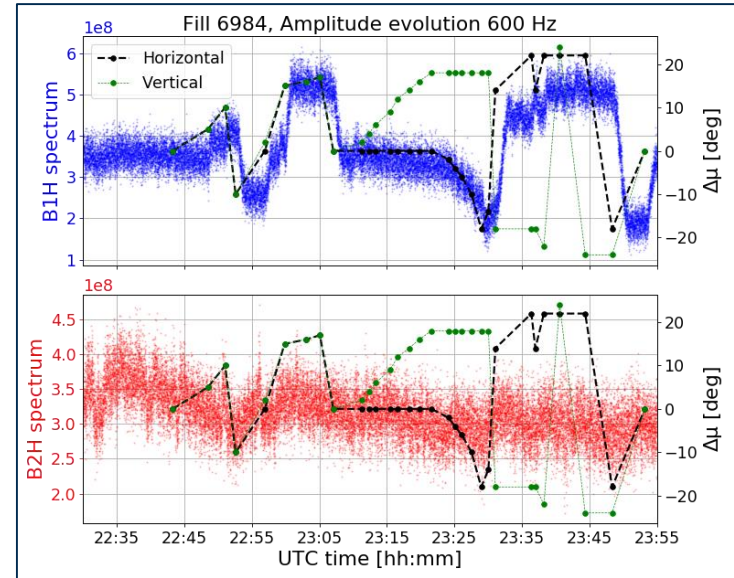
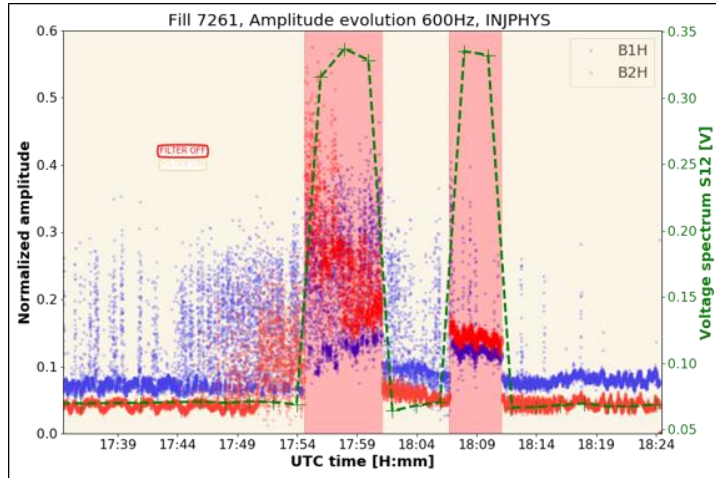
Motivation I

- The goal of this MD is to investigate the source of the 50Hz harmonics and study if there is an impact on the beam.
- Harmonics of 50Hz are visible both in the spectrum of the beam and in the voltage spectrum of the power converter in Sector 12.



Motivation II

- **Active filters:** Tests with active filters showed that the power converters of the main bends contribute to this effect.
- **Phase scan:** There is a change in the amplitude evolution during the phase scan of IP1 & IP5 which we would like to investigate.



Summary of tests during the MD

- Excitation with ADT.
- Tests with active filters: each sector separately.
- Tune scan (down & up to 4th closest harmonic).
- Phase advance knob IP1 & IP5 B1, B2, H,V.
- Injection of controlled noise in RPTE.UA23.RB.A12 and RPTF.SR3.RQ4.LR3.

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At injection [1 INDIV, 12b, 3x48b]



Needed to have a clear signature of the 50Hz in the spectrum

Excitation with ADT

- ❑ **Before starting the full excitation:** Test with 1 INDIV or a few bunches (12b). We will start with an excitation at 2 nrad and proceed max to the limit defined by MPP/collimation BUT we expect to stop much earlier (400 nm).
- ❑ All 3x48b will be then excited at 625Hz, 600Hz and 3150Hz.

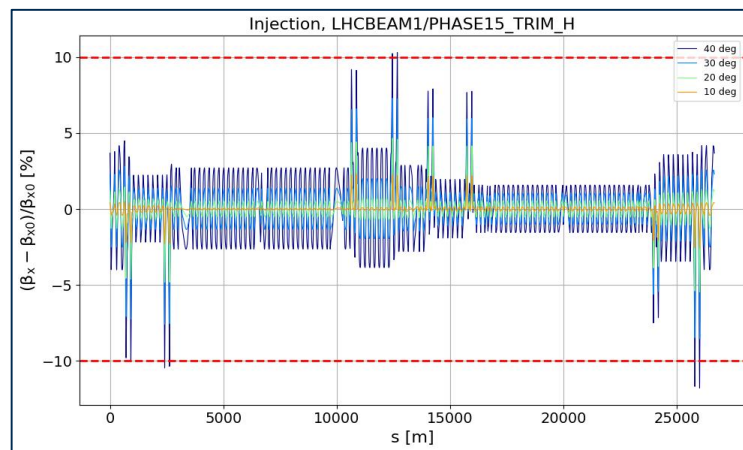
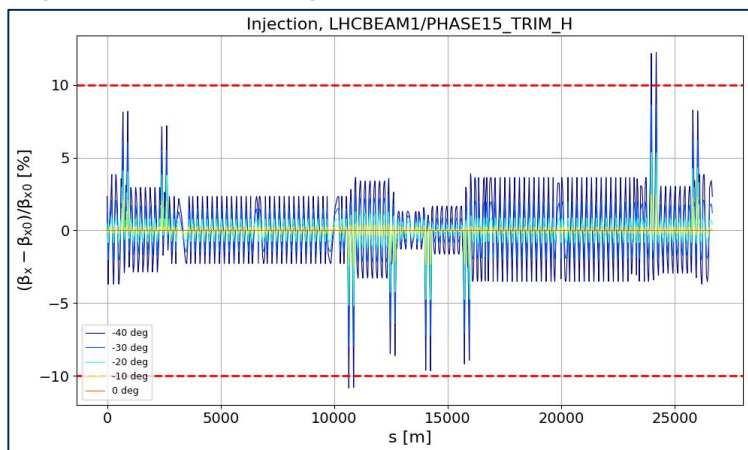
625 Hz	
Kick [nrad]	Offset [σ]
5.2929	0.1

600 Hz	
Kick [nrad]	Offset [σ]
5.3362	0.1

3150 Hz	
Kick [nrad]	Offset [σ]
0.2874	0.1

Phase scan IP1 & IP5

- Phase scan tests between IP1 & IP5 at injection with the knobs PHASE15_TRIM_H/V.
- These knobs were used at top energy [Fills 5477, 6799, 6984..] and there is an impact on the amplitude evolution of the 50Hz harmonics.
- Beta-beating induced by MQT pairs participating to the knob.
- With the proposed range of phases during the MD, **less than 10% beta-beating will be observed**
- MKD-TCT phase advance at injection: MKD.A5L6.B1-TCTPH.4L1.B1 186.588 degrees phase advance, margin of 36.588 degrees.

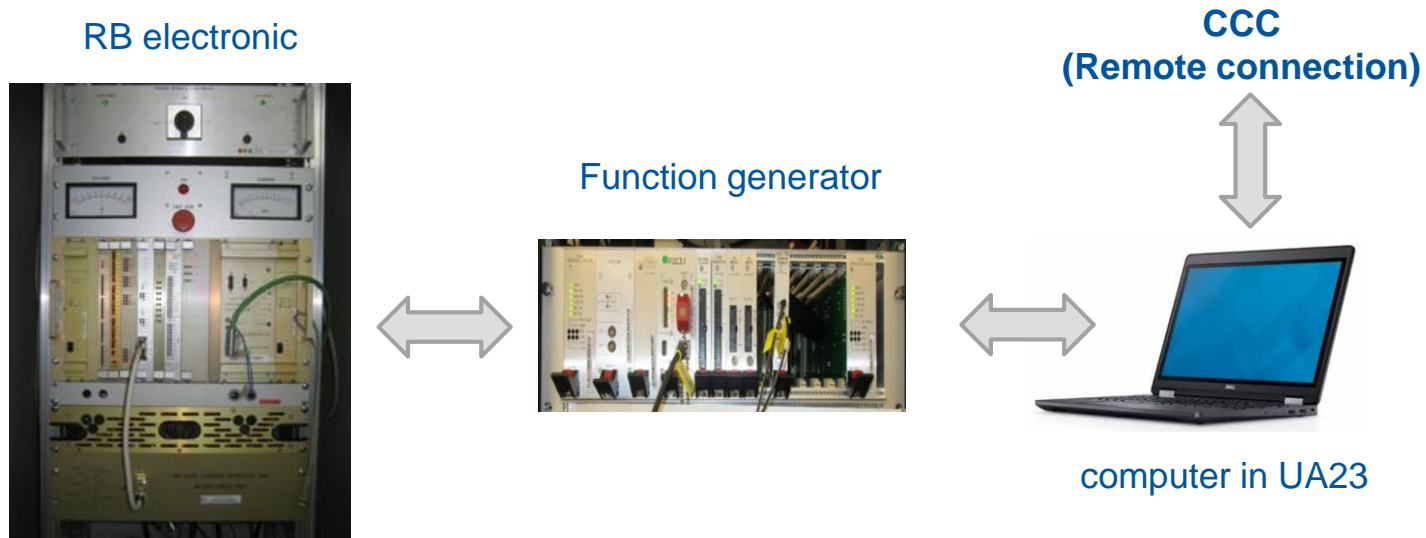


Injection of controlled noise in RPTE.UA23.RB.A12

- ❑ Verify the impact of noise on the beam from the power converter of RPTE.UA23.RB.A12 by injecting an external excitation.
- ❑ One of the control cards of the PC will be replaced with one **spare** which will perturb the reference voltage of the converter (similar to the one installed in SPS) taking as input (also) the external excitation.
- ❑ **No change in the operational card.**
- ❑ ~4h access needed for the modification & testing of the installation, only in case of an access slot during downtime.
- ❑ **Note that, enough time is allocated during this MD for:**
 - **Tests with the new setup without beam**
 - **Tests with 1 INDIV or 12b**
 - **Tests with 3x48b**

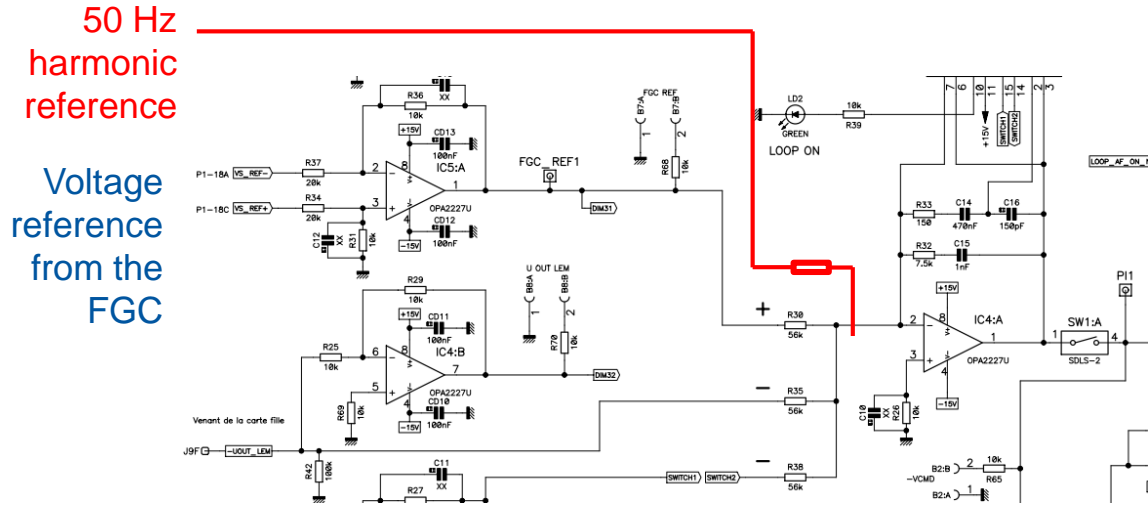
How to inject 50 Hz harmonics on the MB PC?

- Install in the UA23 a function generator to inject 50 Hz harmonics reference in the voltage loop of the main dipole power converter.
- The function generator is controlled by computer installed in the UA23 (remote connection with the CCC).



How to inject 50 Hz harmonics on the MB PC?

- Minor change of the voltage loop electronic card (spare card will be used) of the main dipole power converter.
- Power tests are needed to validate the global system.



50 Hz
harmonic
reference

Voltage
reference
from the
FGC

Voltage loop electronic card of the main dipole power converter

Backup

