
CERN

MD12663: Wire compensation during the β*-leveling

G. Sterbini on behalf of the team

Special thanks to H. Bartosik, P. Bélanger, A. Calia, Y. Dutheil, M. Hostettler, S. Kostoglou, D. Mirarchi , S. Redaelli, A. Rossi, BE-OP, HL-WP2, Collimation team, SY-STI, SY-ABT, SY-RF, MD Coordinators for the input/feedback.

- *"It was proposed to split the MD in two parts to leave more time for the validation. It was agreed to have an rMPP meeting with all parties involved after the validation and before proceeding with the fill with trains."*
- **A validation fill took place last night (F10147).**

rMPP MD12663, September 27, 2024

Recalling the MD sequence

Recalling the MD sequence

1. $\beta^* = 41.5 \rightarrow 38.5 \rightarrow 35.5 \rightarrow 32.5$ cm + $\theta_c = 160$ μrad + **WIRES ON**

Recalling the MD sequence

1. $\beta^* = 41.5 \rightarrow 38.5 \rightarrow 35.5 \rightarrow 32.5$ cm + $\theta_c = 160$ μrad + **WIRES ON**
2. $\beta^* = 30$ cm + $\theta_c = 150$ μrad + **WIRES ON/OFF**

Recalling the MD sequence

1. $\beta^* = 41.5 \rightarrow 38.5 \rightarrow 35.5 \rightarrow 32.5$ cm + $\theta_c = 160$ μrad + **WIRES ON**
2. $\beta^* = 30$ cm + $\theta_c = 150$ μrad + **WIRES ON/OFF**
3. $\beta^* = 30$ cm + $\theta_c \rightarrow$ **130** μrad + **WIRES ON/OFF**

Recalling the MD sequence

1. $\beta^* = 41.5 \rightarrow 38.5 \rightarrow 35.5 \rightarrow 32.5$ cm + $\theta_c = 160$ μrad + **WIRES ON**
2. $\beta^* = 30$ cm + $\theta_c = 150$ μrad + **WIRES ON/OFF**
3. $\beta^* = 30$ cm + $\theta_c \rightarrow$ **130** μrad + **WIRES ON/OFF**
4. $\beta^* = 30$ cm + $\theta_c = 130$ μrad + **WIRES ON/OFF** + **tight collimators**

Recalling the MD sequence

1. $\beta^* = 41.5 \rightarrow 38.5 \rightarrow 35.5 \rightarrow 32.5$ cm + $\theta_c = 160$ μrad + **WIRES ON**
2. $\beta^* = 30$ cm + $\theta_c = 150$ μrad + **WIRES ON/OFF**
3. $\beta^* = 30$ cm + $\theta_c \rightarrow$ **130** μrad + **WIRES ON/OFF**
4. $\beta^* = 30$ cm + $\theta_c = 130$ μrad + **WIRES ON/OFF** + **tight collimators**
5. $\beta^* = 30$ cm + $\theta_c = 130$ μrad + **WIRES ON/OFF** + tight collimators + **scraping**

Loss Maps Matrix summary

Validation test	Loss Maps Matrix						
	β* (cm)						
	41.5	38.5	35.5	32.5	30.0	30.0	30.0
	Xing (μrad)						
	160	160	160	160	130	130	130
	Collimator settings						
	Nominal	Nominal	Nominal	Nominal	Nominal	Tight	Tight
	BBLR						
	ON	ON	ON	ON	ON	ON	OFF
B1H	✗	✗	✗	✗	✗	✗	✗
B1V	✗	✗	✗	✗	✗	✗	✗
B2H	✗	✗	✗	✗	✗	✗	✗
B2V	✗	✗	✗	✗	✗	✗	✗
+dp/p	✗					✗	
-dp/p	✗					✗	
ASD						✗	

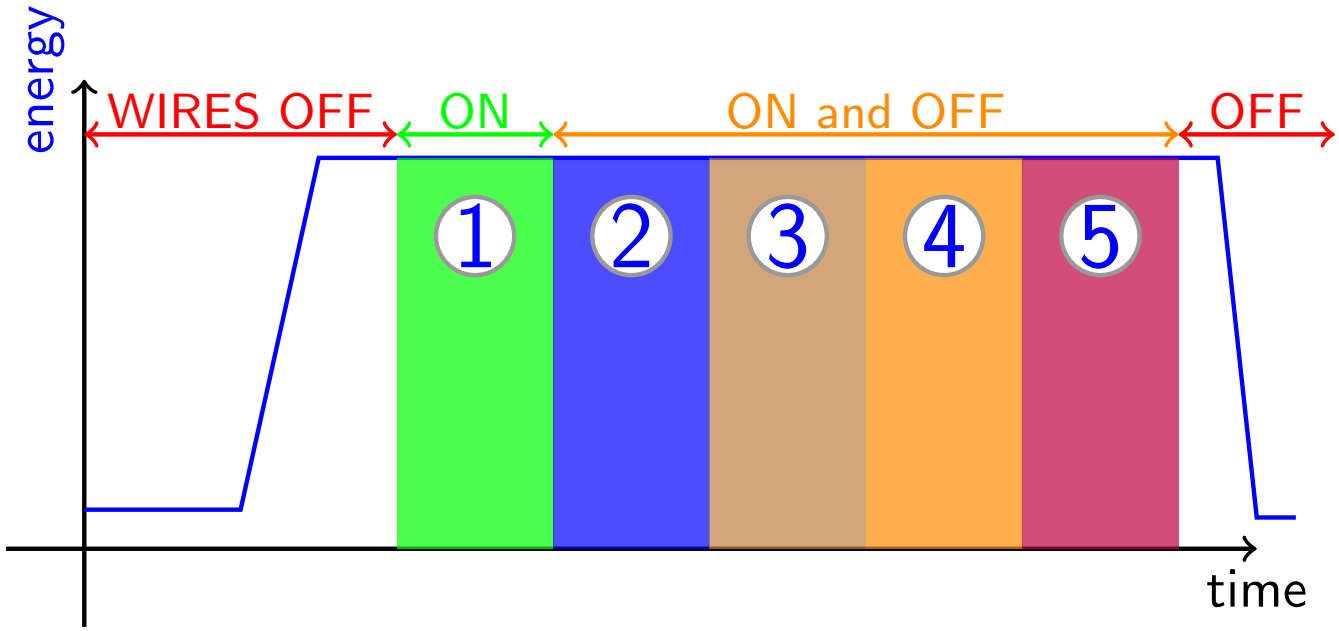
Courtesy of D. Mirarchi.

MD3 rMPP[1]

- *"Georges commented that 14 pilot bunches are required to perform the 7 required Loss Maps."*
- → **An INDIV and 17 probes** were injected in B1 and B2 (Single_42b_1_0_0_IP15HO_noLR).

[1] See https://indico.cern.ch/e/1444697.

Masking of the WIRES PC interlocks (repetition)



- In the step 2-5 of the MD we would like to cover the [0-350] A range of the wires current to see the effect **w/** and **w/o** compensation at the different configurations (e.g. lower crossing angle and tighter collimators settings), and to have the possibility to explore intermediate values of the wire currents.
- **BUT** the PC interlock of the other PCs (namely the quadrupoles of the matching section used for the Q-feedforward) will **not be masked**.

MD3 rMPP[2]

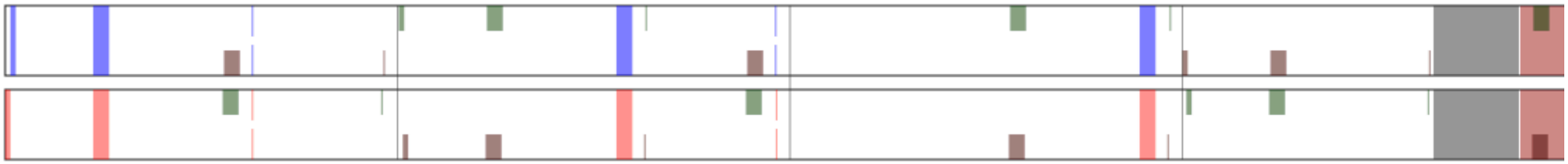
- "Jorg asked what the tight settings are and if the TCDQ is moved. Guido confirmed and added that Daniele prepared a beam process for this."
-

$\beta*$=30cm at 150 μm	OPERATION	MD
TCP	5.0	5.0
TCS	6.5	6.0
TCDQ	7.3	6.8
TCT - H	8.5	7.5
TCT - V	8.0	7.5

[2] See https://indico.cern.ch/e/1444697.

To be decided after LM and ASD scrutiny

Proposed scheme 25ns_122b_109_0_0_36bpi_6inj_forMD12663 scheme for tomorrow's fill.



- 12b at 1.6e11ppb
- 2×36b at 1.6e11ppb
- **36b at 1.8e11ppb**
- 2×INDIV at 1.6e11ppb

Thank you for your attention.


CERN

MD12663: BBLR compensation and β*-leveling (I)

- Wire compensation in a full dynamics configuration
  - Wires compensators are used systematically in the operation at the end of the fills (end of $\mathcal{L}$-levelling). Despite the limited potential, excellent opportunity to integrate them in the machine cycle. When the wires are activated, the machine is almost static (β^*=30 cm, θ_c=150 μrad, TCT gap constant);
  - To prove their potential in the HL era, it is paramount to show that the wires can be ON during the full $\mathcal{L}$-levelling process, that is while $\beta*$, crossing angles, TCT gaps/positions are changing. The MD aims to test a full-fledged and realistic orchestration of all the previous parameters in the segment $\beta^* = 41.5 \rightarrow 30$ **cm**.
- **1 validation fill (≈4 h) + 1 fill with trains (≈8 h)**
  - Fill A: 1 INDIV + PILOTS per beam;
  - Fill B: 3(**?**)×36b trains + 2 INDIV per beam at **1.6e11 ppb**;

MD12663: BBLR compensation and β*-leveling (II)

- Play the standard cycle up to beam collision at top energy
  - $\mathcal{L}$-optimization at β^*=120 cm but skip ϵ scan;
  - go w/o $\mathcal{L}$-levelling to 41.5 cm and switch ON the wires (optimize tunes before and after);
  - continue with wires ON until 30 cm;
  - cycle the wires ON-OFF-ON (optimize the tunes);
  - close the crossing angle from 150 to 130 μrad and cycle the wires ON-OFF.
  - perform a diffusion measurement with wires OFF and ON (**if time allows**).

Link 1
Link 2