



MD2202

Y. Papaphilippou, A. Rossi and G. Sterbini on behalf of the BB WG and the enlarged BB team. Special thanks: S. Redaelli, M. Solfaroli, M. Pojer, S. Fartoukh, D. Pellegrini, K. Karastatis, M. Gonzales, R. Bruce, A. Poyet.

27th June 2017, rMPP

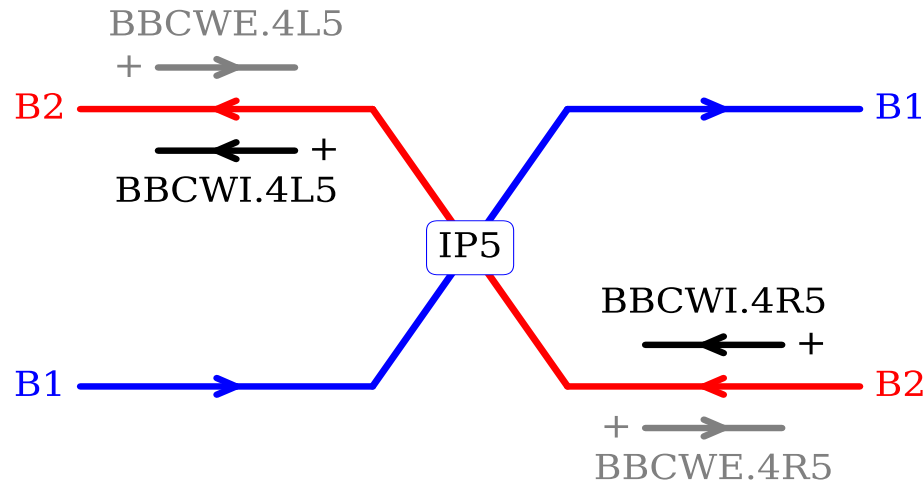
Comments from MPP

- **JW: Very ambitious program, a bit over-optimized in time (everything super optimistic). Moving the TCTs to 6 sigma should then require the TCSP6 to be closed much further in. I see a significant risk of dump with TCTs that close and at the same time complex manipulations. For point 6 of the first fill, this is way to vague and cannot be accepted as such. The bumps must be defined and their range given, else the risk for the triplet is too high. For this item more details or clear no.**
- **JU: Up to trains of 48 bunches and some nominals. Collimator gaps stay nominal. Reducing crossing angles --> TCTs and TCL movement. See comments by Jorg, agree.**
- **MZ: In addition to comments already given, foresee some time (e.g. during ramp-down) to re-validate HW interlocks before MD.**
- **DW: B1: 48b +2 INDIVs / 3x48b; B2: 3xINDIV / 3x48b. Comments to planned program see Jorg with TCTP/ TCL to 6 sigma. MD class C.**

CLASSIFICATION C: Emittance blow-up protocol not defined, interlock of wire check not specified. Too optimistic....

General comment on the optimism

- We are aware that we cannot complete the full program in 10 h. The presented procedure considers full (ambitious) program (as initially presented to LSWG 23.05). Our priority is the first fill ($B2 < 3e11$ p). Some of the test we hoped to do on the intensity ramp-up had to be absorbed in the MD (vertical alignment, blow-up, second fill...).
- We maintained the full program to present the overall approach and maintain flexibility in case of fallback scenarios to profit at best of the MD times. We marked in the procedure (**'IF time allows'**) the steps that are NOT the priority for this MD1 and could be covered in the next MD blocks.



1st FILL

B1:

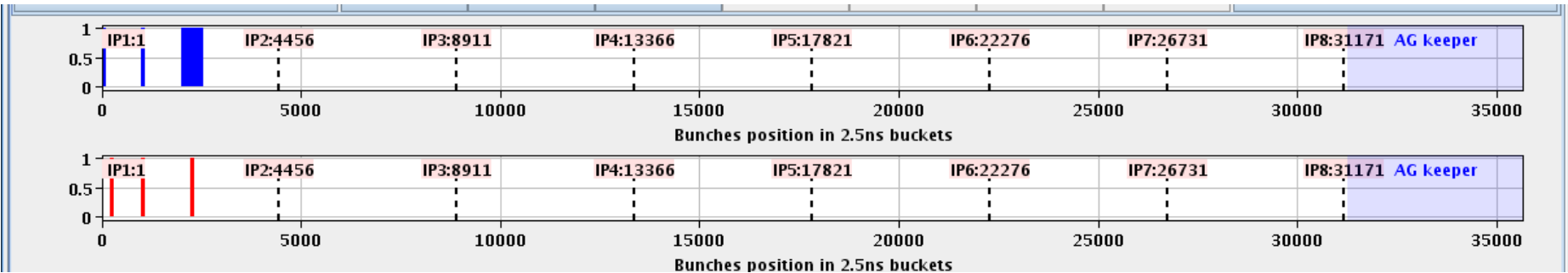
- 48 bunches
- 1 NOMINAL (2 HO, no LRBB)
- 1 NOMINAL (0 HO, no LRBB)

B2: **safe beam**

- Bunch #1: 1 NOMINAL (2 HO in IP1 and IP5, and ~60 LRBB in IP1 and IP5)
- Bunch #2: 1 NOMINAL (2 HO in IP1 and IP5, but no LRBB)
- Bunch #3: 1 NOMINAL (no HO, no LRBB)

25ns_50b_2_0_0_48bpi_MD2202

RFBucket	Bu Tot	bu/btch	Spc/ns	PSbchs	level	RFBucket	Bu Tot	bu/btch	Spc/ns	PSbchs	level
1	1	1	0	1	NOM	201	1	1	0	1	NOM
1001	1	1	0	1	NOM	1001	1	1	0	1	NOM
2001	48	48	25	1	NOM	2241	1	1	0	1	NOM



2nd FILL

B1:

- 3x48 bunches
- 1 NOMINAL
 - (2 HO, no LRBB)
- 1 NOMINAL
 - (0 HO, no LRBB)

B2:

- 3x48 bunches
- 1 NOMINAL (2 HO, no LRBB)
- 1 NOMINAL (0 HO, no LRBB)

LHC Injection Scheme editor v 1.3.6

INJECTION SCHEME EDITOR | BUNCH PATTERN EDITOR

Injection scheme builder | add injection request to scheme | display existing injection request

Injection schemes

show filter

clear filter

25ns_146_145_0_0_40bpi_MD2202

25ns_50b_2_0_0_48bpi_MD2202

Scheme Name: 25ns_146_145_0_0_40bpi_MD2202

Inj scheme group: 25ns

Creation Date: Jun 26, 2017 10:02:31 AM

Description: Filling scheme for second fill MD2202

Collisions in IP1: 145

Collisions in IP2: 0

Collisions in IP5: 145

Collisions in IP8: 0

OverInjection: CleaningEnabled:

Pilot B1: ▲▲▲▲▲ 1 Pilot B2: ▲▲▲▲▲ 1

RFBucket	Bu Tot	bu/btch	Spc/ns	FSbchs	level
1	1	1	0	1	NOM
1001	1	1	0	1	NOM
2001	48	48	25	1	NOM
3001	48	48	25	1	NOM
4001	48	48	25	1	NOM

25ns_146_145_0_0_40bpi_MD2202

Refresh list

Delete

B1_25ns1Batch48Bu_bu3001_N

B2_25ns1Batch48Bu_bu2001_N

CSV file | new | edit | save | cancel | REMOVE >> FROM B1 | REMOVE >> FROM B2

COMPUTED INFO

	A	B
Nbr OF BUNCHES B1		
Nbr OF BUNCHES B2		
Nbr COLLISIONS IP1		
Nbr COLLISIONS IP2		
Nbr COLLISIONS IP5		
Nbr COLLISIONS IP8		
PILOT POSITION B1		
PILOT POSITION B2		

COMPUTE SCHEME INFO

DISPLAY HEAD-ON COLL

COPY INTO SELECTED SCHEME

Shift group of injections

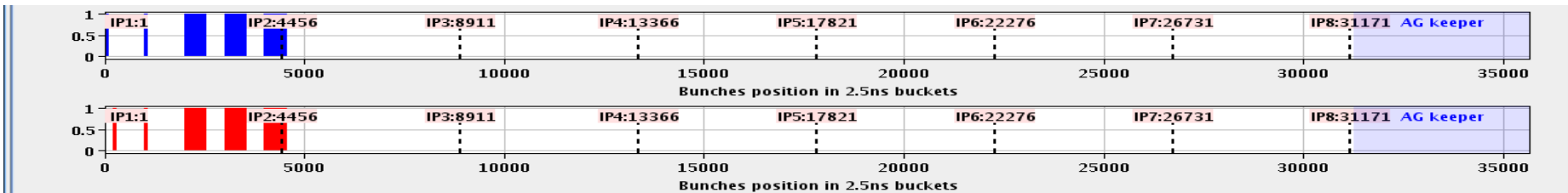
B1 B2

from bucket: 2000 To 11000

Nbr of buckets 1000

shift direction << >>

DISPLAY BUCKET LIST



Procedure to check the HW interlock

M. Gonzales

Procedure already tested.

TCTW Wire Control

May 23, 2017 11:43:02 AM

Left Collimator (TCL.4L5.B2)

External Wire (BBCWE.L5.B2)

Measured Voltage	<input type="text" value="0.0"/>	V
Relay Status	<input type="text" value="1.0"/>	
Relay Voltage Threshold	<input type="text" value="2.9"/>	V

Internal Wire (BBCWI.L5.B2)

Measured Voltage	<input type="text" value="0.0"/>	V
Relay Status	<input type="text" value="0.0"/>	
Relay Voltage Threshold	<input type="text" value="0.0"/>	V

Power Converter (RPMC.USC55.RBBCW.L5B2)

Status	<input type="text" value="FLT_OFF"/>	
Measured Current	<input type="text" value="0.0021961364"/>	A
Reference Current	<input type="text" value="0.0"/>	A
Measured Voltage	<input type="text" value="0.112573996"/>	V
Reference Voltage	<input type="text" value="0.0"/>	V

Vacuum

Pressure (VGPB.935.4L5.R)	<input type="text" value="Not Implemented"/>
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Right Collimator (TCTPH.4R5.B2)

External Wire (BBCWE.R5.B2)

Measured Voltage	<input type="text" value="0.0"/>	V
Relay Status	<input type="text" value="1.0"/>	
Relay Voltage Threshold	<input type="text" value="2.9"/>	V

Internal Wire (BBCWI.R5.B2)

Measured Voltage	<input type="text" value="0.1"/>	V
Relay Status	<input type="text" value="1.0"/>	
Relay Voltage Threshold	<input type="text" value="2.9"/>	V

Power Converter (RPMC.UL557.RBBCW.R5B2)

Status	<input type="text" value="OFF"/>	
Measured Current	<input type="text" value="-0.0012238115"/>	A
Reference Current	<input type="text" value="0.0"/>	A
Measured Voltage	<input type="text" value="0.11871439"/>	V
Reference Voltage	<input type="text" value="0.0"/>	V

Vacuum

Pressure (VGPB.935.4R5.R)	<input type="text" value="Not Implemented"/>
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- M. Gonzales will test the HW interlock before the MD (e.g., during the recovery time of previous MD, MD2036)

Input from the collimation team (I)

R. Bruce

Settings in MD on BBLR wire compensation

- Assumptions for MDs at 6.5 TeV, 40 cm:
 - 1 strong beam (train), B1
 - 1 weak beam (intensity $< 3E_{11}$), B2, affected both by long-range interactions from B1 and wire
- MP considerations: Above $3E_{11}$ protons, interlocks cannot be masked
 - For strong beam, collimator settings should be identical to the settings qualified for physics operation
 - Collimator settings in sigma not affected by change of crossing, but center must change
 - Even at a smaller crossing or larger β^* , we cannot approach the beam further in units of σ in order to respect the collimation hierarchy
 - If we squeeze β^* further during the year, a machine configuration with tighter will have to be qualified => potentially beneficial for the MDs



R. Bruce, 2017.03.20

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<https://indico.cern.ch/event/615088>

Input from the collimation team (II)

R. Bruce

Collimator settings for the weak beam

- Staying with total intensity below $3E11$ protons => more freedom to mask interlocks and change settings
 - Need to use setup beam flag on one beam only
- Cleaning efficiency of IR7 collimation system not critical at very low intensity
- More “exotic” collimation schemes could be envisaged
- Still, staying long time in a given configuration, we should operate the horizontal TCTs 1σ outside cut of TCSP in IR6 and the IR7 TCPs
 - Example configuration: TCPs and TCSP at 5σ , TCTs at 6σ ($\epsilon_n=3.5\mu\text{m}$)
 - Recommended to do betatron loss maps in such a configuration during commissioning => can obtain limits on allowed losses before BLMs dump, and check where we would dump



R. Bruce, 2017.03.20

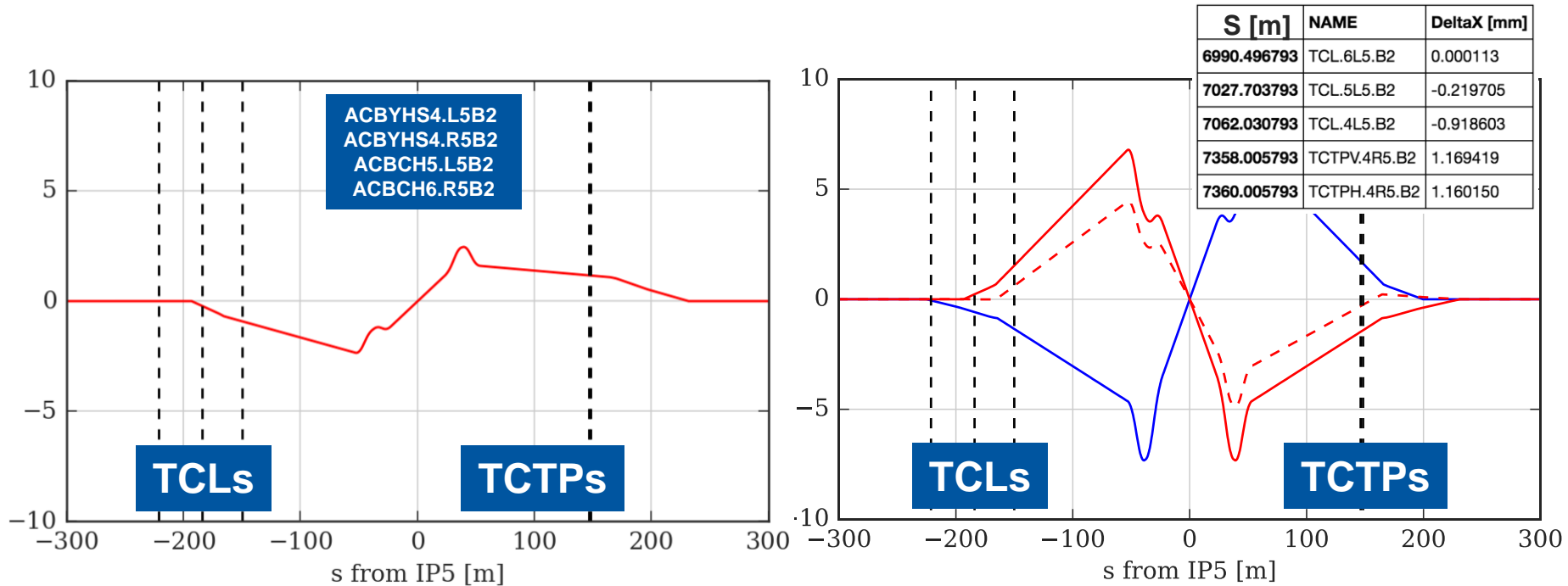
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Indeed the configuration we assumed was TCP and TCSP6 at 5 sigma. This important details was missing in the procedure. **We will add it.**

Concerning the change of the B2 Xing

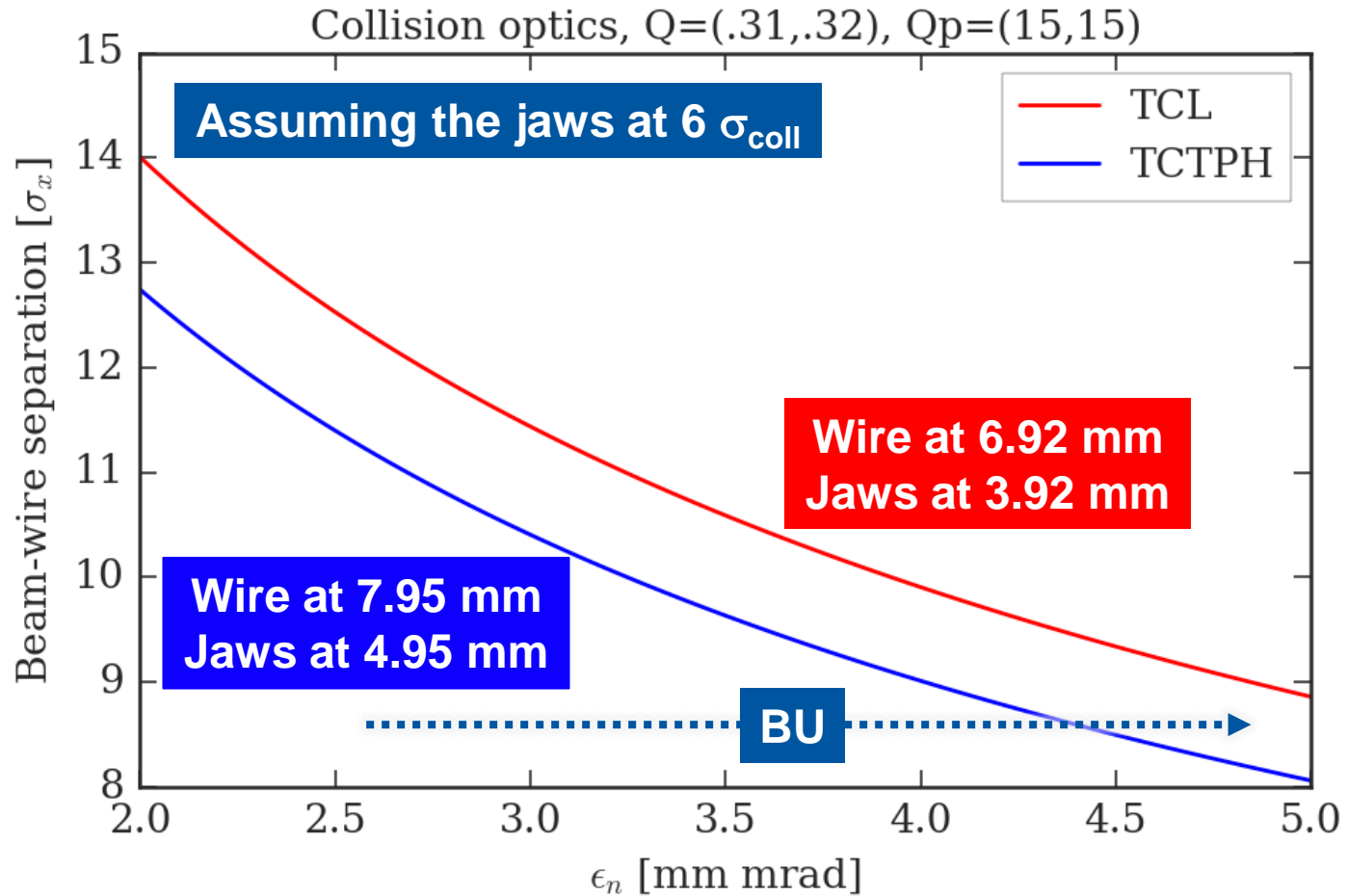
As mentioned during the LBOC LSWG 23.05 by S. Fartoukh, among the different hypotheses for the asymmetry B1/B2 there could be an asymmetry between px of B1/2 at IP1/5. S. Fartoukh prepared the optics knobs to trim these angles and check experimentally this hypothesis. The knob is not commissioned.

This point is not a priority for the BBWC MD (“IF time allows”). Ideally the knob commissioning should have been commissioned during the intensity ramp-up.



Blow-up procedure

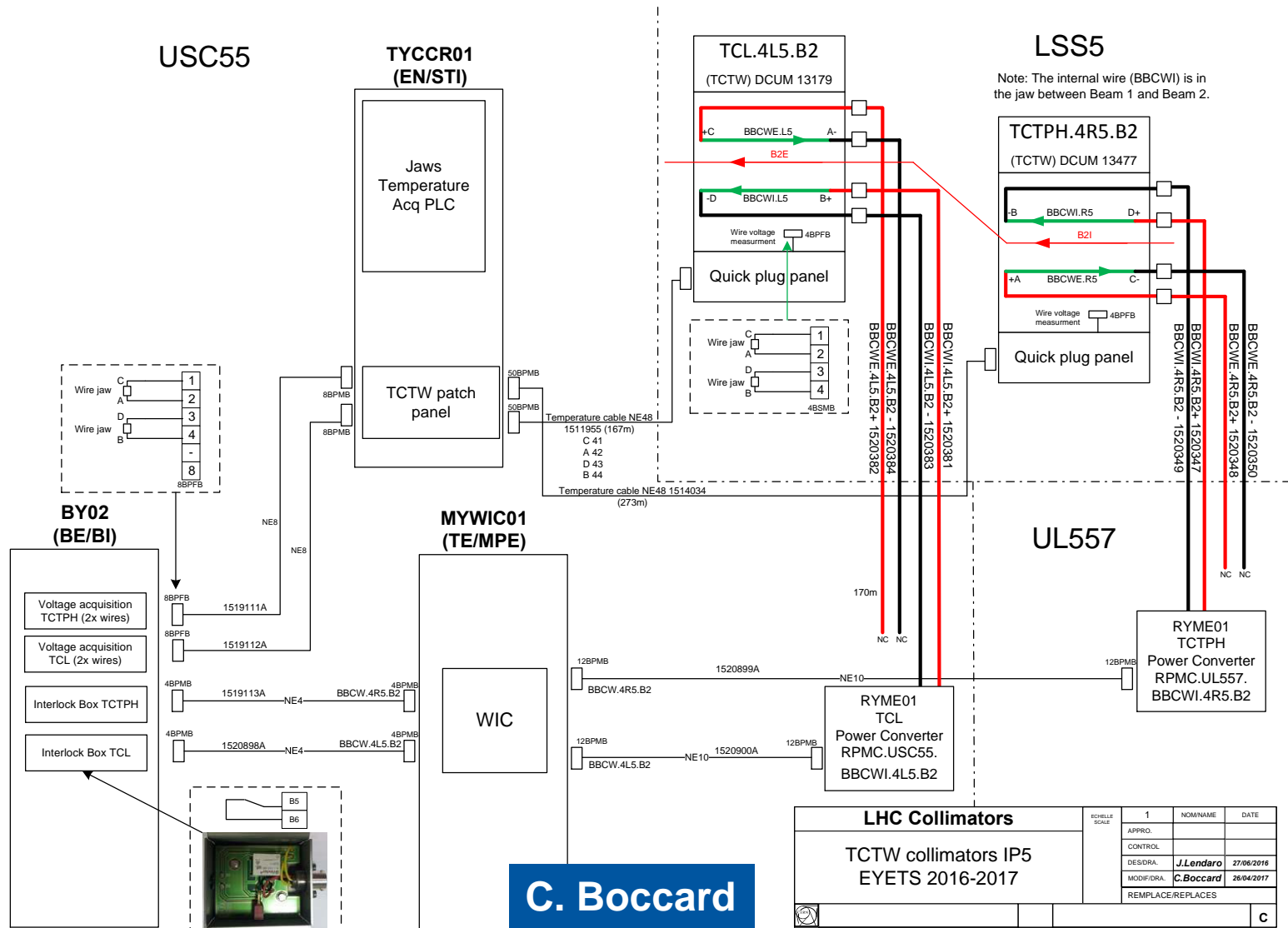
The blow up will apply on the B2 beam after collision to gently blow-up the emittance in steps from 2.5 urad up to 5 urad. We will start from the H plane.



Thank you for the attention!

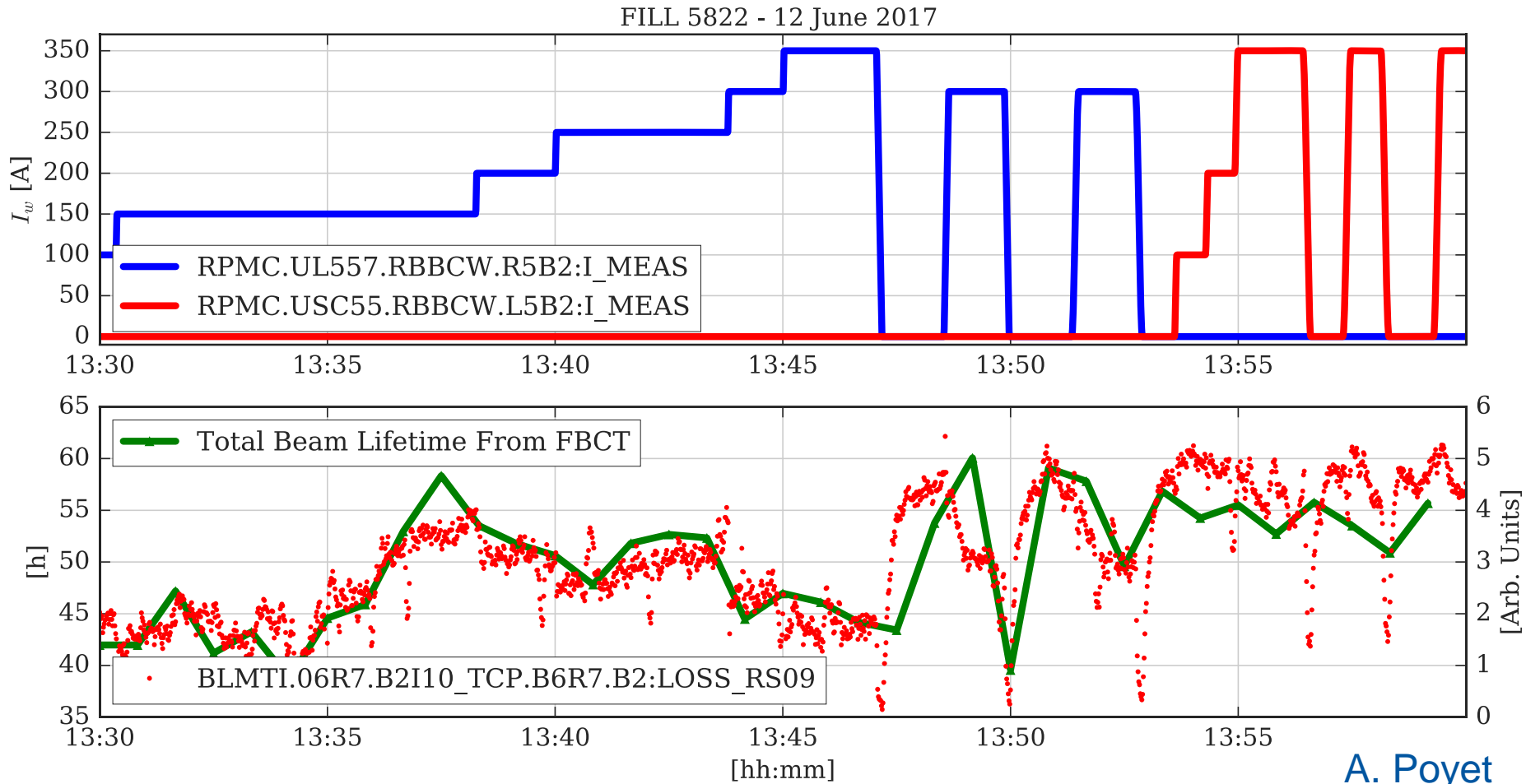


Procedure to check the HW interlock



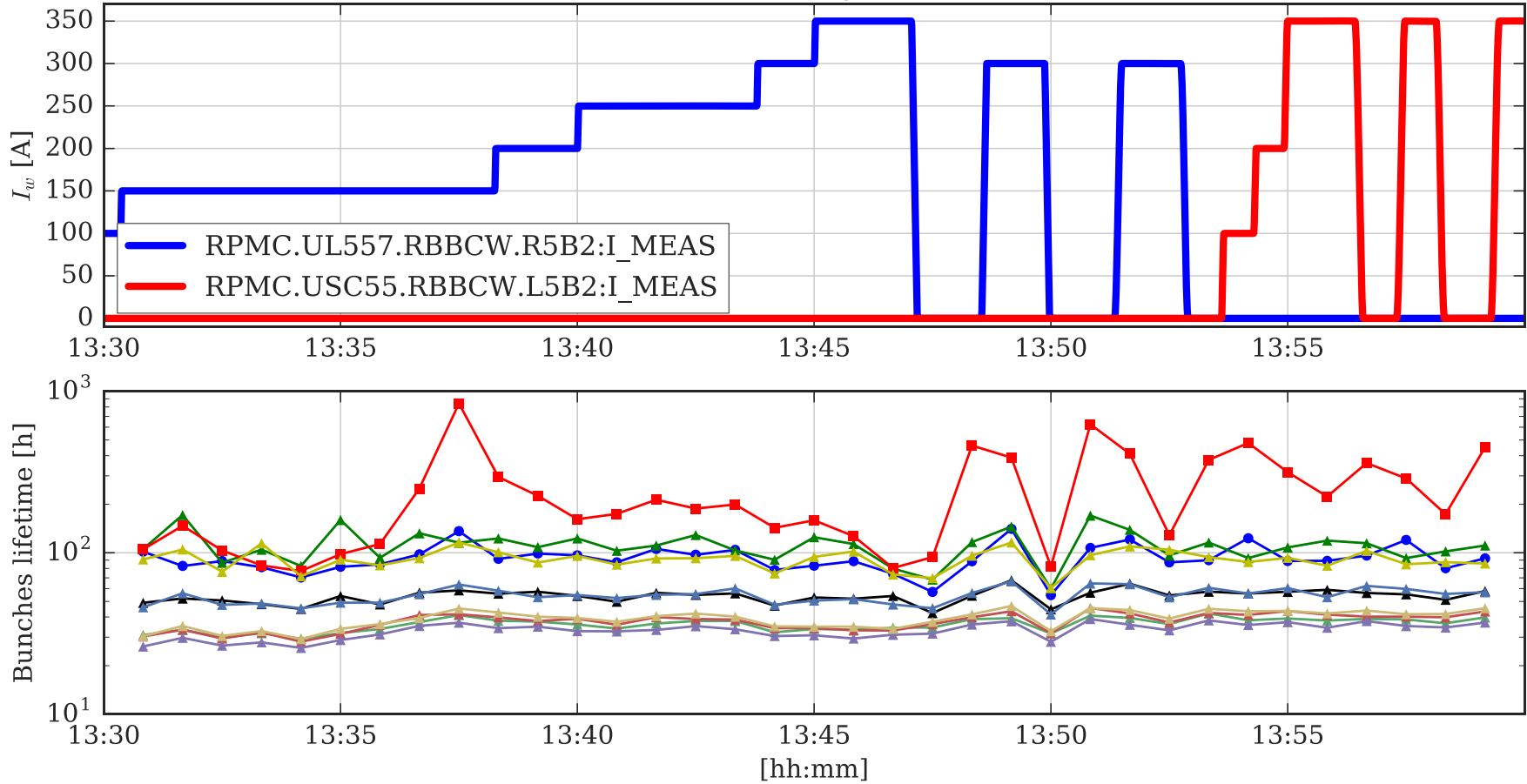
LHC Collimators		SCHELE SCALE	1	NOMINAME	DATE
TCTW collimators IP5 EYETS 2016-2017		APPRO.			
		CONTROL			
		DESIGNA.	J.Lendaro		27/06/2016
		MODIF/DRA.	C.Boccard		26/04/2017
		REPLACE/REPLACES			

End of FILL5822



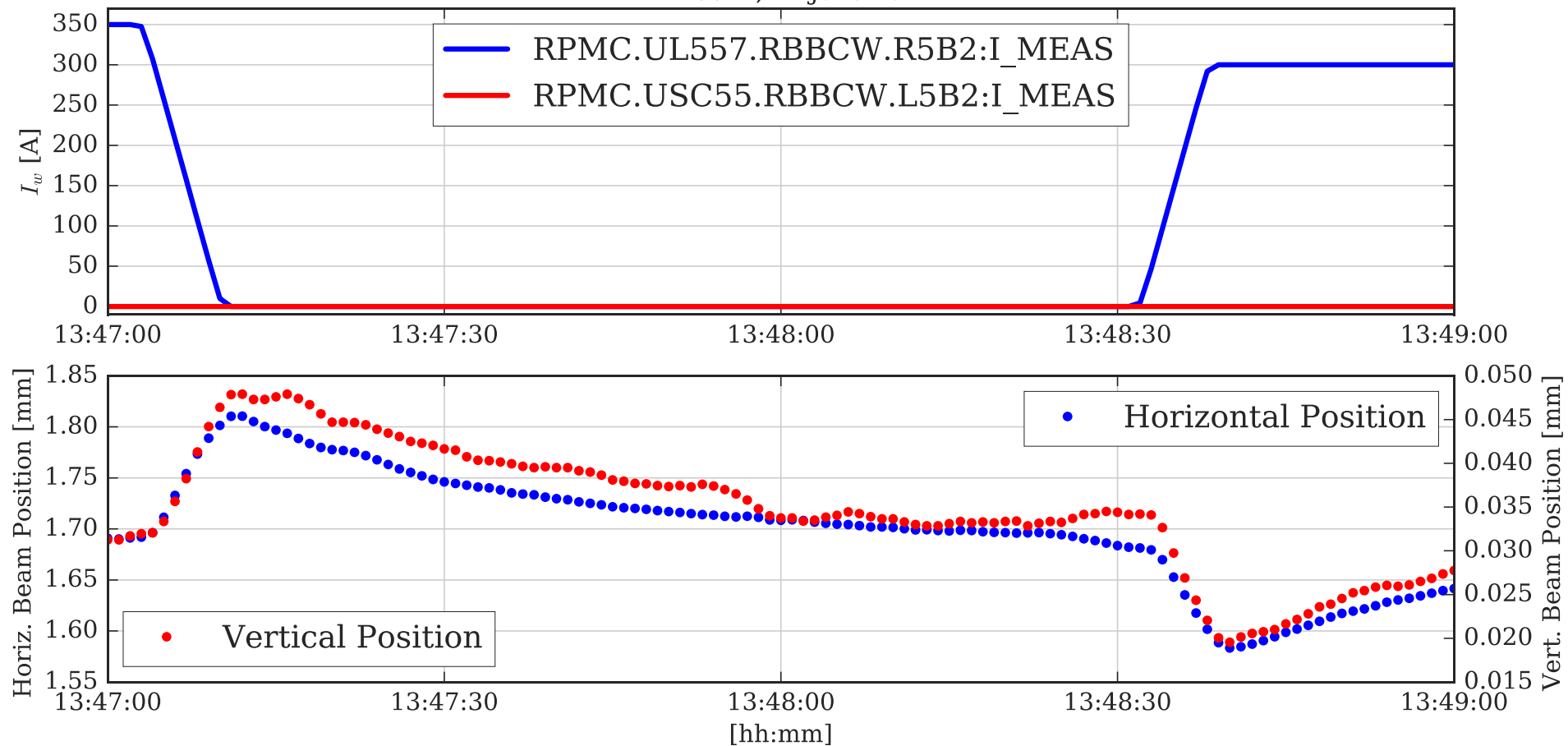
A. Poyet

FILL 5822 - 12 June 2017



A. Poyet

FILL 5822, 12 June 2017



A. Poyet