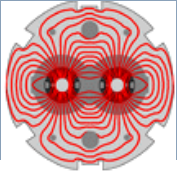


Orbit feedback during stable beams

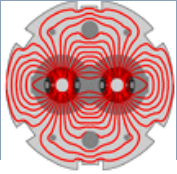
How to configure and use

L. Ponce, J. Wenninger



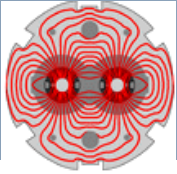
- ❑ To obtain a smoother orbit correction in stable beams, the orbit FB is reconfigured and switched on to provide a continuous racking of the error. This replaces the autopilot, that led to a sequence of orbit drift – trim back steps.

- ❑ The following slides present the steps required to use the OFB in stable beams:
 - ✓ *Run a sequence to reconfigure the OFB parameters,*
 - ✓ *Check within YASP that the reconfiguration was applied correctly,*
 - ✓ *Send the current orbit to the OFB,*
 - ✓ *Switch on the OFB !*



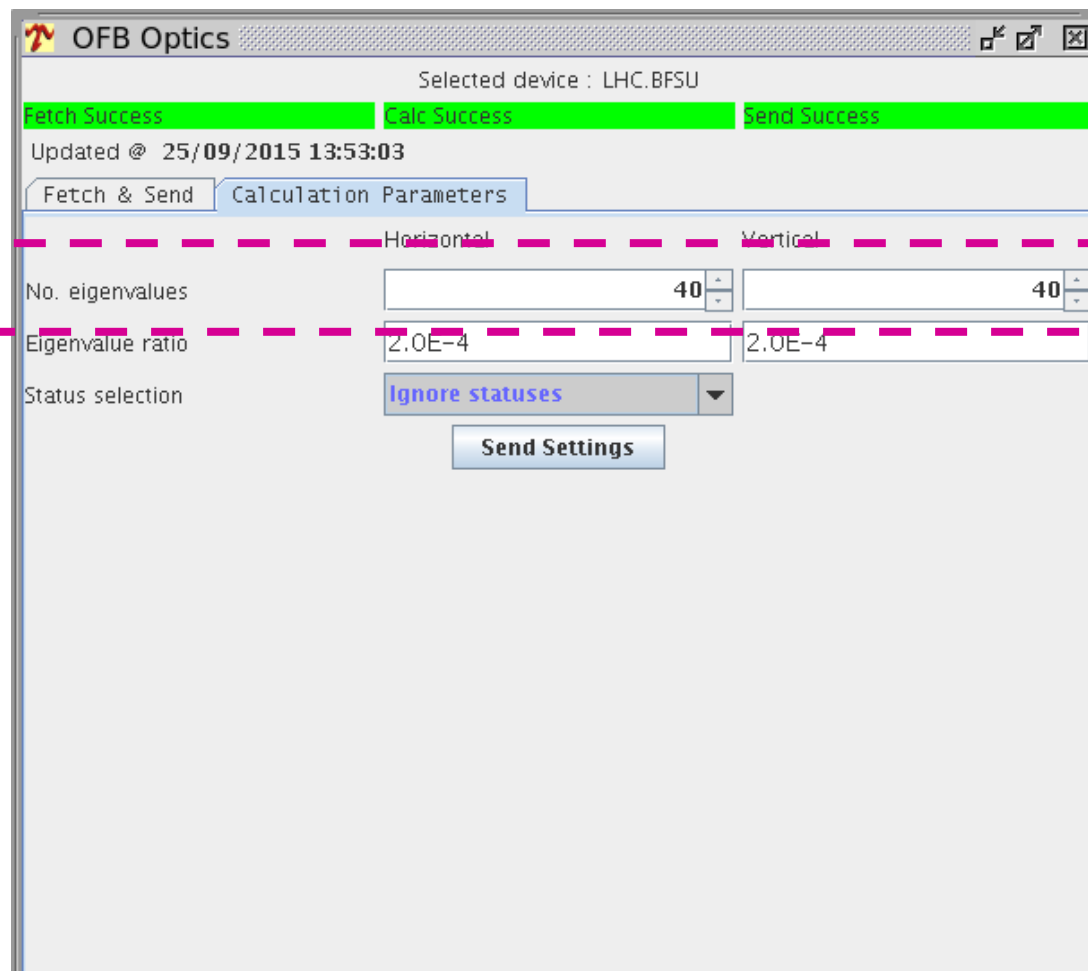
- Run this sequence: it ensures the FBs are OFF, trims down the gains, prepares the optics & response matrix.
- This sequence is only valid for the 80cm stable beams configuration.

Because of those 2 tasks



Verify the number of eigenvalues for the correction – it should be 40 for both planes.

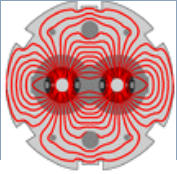
- *The ramp squeeze defaults are 390 (H) and 420 (V)*



The screenshot shows the 'OFB Optics' window with the 'Calculation Parameters' tab selected. The 'Horizontal' and 'Vertical' columns are visible. The 'No. eigenvalues' field is set to 40 for both planes, and the 'Eigenvalue ratio' is set to 2.0E-4. A 'Send Settings' button is located at the bottom. A dashed pink box highlights the 'No. eigenvalues' and 'Eigenvalue ratio' fields for both planes.

	Horizontal	Vertical
No. eigenvalues	40	40
Eigenvalue ratio	2.0E-4	2.0E-4

Check the optics



Make sure the physics optics (R2015a_A80C80A10m_...L300_...) is loaded into the BFSU.

Selected device : LHC.BFSU

Fetch Success Calc Success Send Success

Updated @ 25/09/2015 17:27:47

Fetch & Send Calculation Parameters

Optics List

Fetch Optics Calc. Selected Upload Selected Manual Update

Id	Loadable	Optics names
2728	false	R2015a_A11mC11mA10mL10m_INJ
2727	true	R2015a_A11mC11mA10mL10m
2734	true	R2015a_A250C250A10m_0.00950L500_0.00886
2739	true	R2015a_A80C80A10m_0.00950L300_0.00875

Active Optics

BFSU: 2739 - R2015a_A80C80A10m_0.00950L300_0.00875

OFC - Hor: R2015a_A80C80A10m_0.00950L300_0.0087

OFC - Ver: R2015a_A80C80A10m_0.00950L300_0.00875

Status Messages

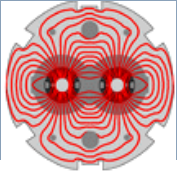
Fetch Optics Optics Upload Calc Optics Eigenvalues

Add elementes for optic 'R2015a_A11mC11mA10mL10m' for plane 0 called '1088' times
 Add elementes for optic 'R2015a_A11mC11mA10mL10m' for plane 1 called '1088' times
 Add elementes for optic 'R2015a_A250C250A10m_0.00950L500_0.00886' for plane 0 called '1088' times
 Add elementes for optic 'R2015a_A250C250A10m_0.00950L500_0.00886' for plane 1

If the OFC-Hor and OFC-Ver names do not agree, re-send the optics: task 'Set active optics id....' in the sequence.

This is in general only a delay in publication.

Check the gains



Click on 'Refresh LSA & BFSU'

The OFB gain ('User BW scaling') should be set to **0.2**.

The ramp / squeeze settings are in the range 1-2

OFB Control Device: LHC.BFSU

Control Reference Orbit Bandwidth RT Trims

Energy FB Radial FB Orbit FB

Orbit FB

	LSA	BFSU
Open Loop Bandwidth OLBW [1/s]	10.0	
Loop Bandwidth BW [1/s]	0.025	
Gain Mode	USER	USER
User Bw Scaling Gf (Mode = USER, BM = SQUEEZE)	0.2	0.2
Gf (BM = STABLE)	0.1	0.1
factor Gf		0.2

Trim LSA Refresh LSA & BFSU

$\Delta E(n) = K_p * (E(n) - E(n-1)) + K_i * T_s * E(n)$
 $K_p = G_f * BW / OLBW$ 0.0005
 $K_i = G_f * BW * 2\pi$ 0.0314
 $K_i * T_s = G_f * BW * 2\pi * T_s$ 0.0013

OFB Control Device: LHC.BFSU

Control Reference Orbit Bandwidth RT Trims

Energy FB Radial FB Orbit FB

Radial FB (RF)

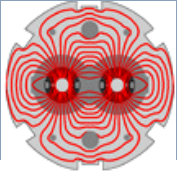
	LSA	BFSU
Open Loop Bandwidth OLBW [1/s]	10.0	10.0
Loop Bandwidth BW [1/s]	0.1	0.1
Gain Mode	USER	USER
User BW Scaling Gf (USER, BM = STABLE)	0.02	0.02
Active BW scaling factor Gf		0.02

Trim LSA Refresh LSA & BFSU

Loop Parameters
 FB correction $\Delta E(n) = K_p * (E(n) - E(n-1)) + K_i * T_s * E(n)$
 Proportional: $K_p = G_f * BW / OLBW$ 0.0002
 Integral: $K_i = G_f * BW * 2\pi$ 0.0126
 Integral: $K_i * T_s = G_f * BW * 2\pi * T_s$ 0.0005

The radial Fb gain ('user BW scaling') should be set to **0.02**.

The ramp / squeeze settings are ~0.5



OFB Reference Orbit Catalog

Filter: 2015 Device: LHC.BFSU

id	name
1651	R2015-highbeta-19m
1664	R2015-highbeta-75m
1658	R2015-highbeta-43m
1796	R2015-flat nominal
1673	R2015-mediumbeta-21m
1642	R2015-flat-top
2048	MD2015-blevel-150cm
2041	MD2015-blevel-80cm
2050	MD2015-blevel-90cm
2097	R2015-ions-150cm
2047	MD2015-blevel-200cm
1935	R2015-Collisions-IR15
1833	R2015-SqueezeCom
2049	MD2015-blevel-100cm
1914	R2015-desqueeze-collint1
2100	R2015-ions-300cm
1657	R2015-highbeta-40m
1645	R2015-mediumbeta-14m
1853	R2015-Colls@450GeV

Overlays

Custom Scalings Use base orbit Global Overlays Factor: 1.00

name	type	fact
------	------	------

In YASP open the FB reference catalog panel, click on 'Send Active to BFSU'

Buttons: Refresh, New Entry, Load, Load >> Ref, Add to active, Send to BFSU, **Send Active to BFSU**, Load from BFSU, BFSU >> Ref

The current orbit will be send to the BFSU (!! *YASP must be acquiring orbits !!*)

The reference orbit is updated with the date & time



OFB Control

Device: LHC.BFSU

Control Reference Orbit BandWidth RT Trims

Arm / Dis-arm OFB Trigger / abort ref. change

Time since last update **8 seconds**

Last orbit upload @ **25/09/2015 13:53:37**

Is using measured orbit **false**

Last event sent @ **25/09/2015 13:47:25**

Last event payload **9999**

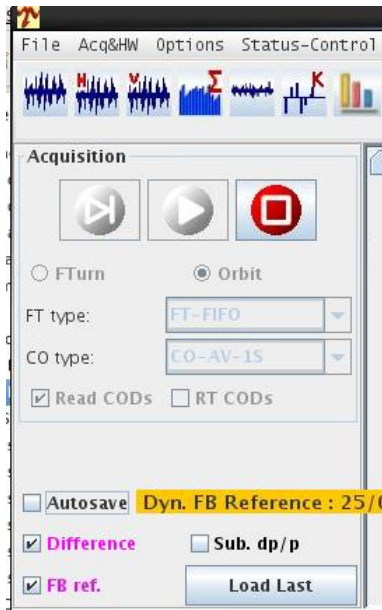
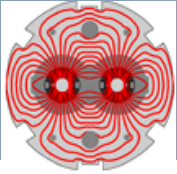
Time since last event (s) **524**

Current time constant (s) **1**

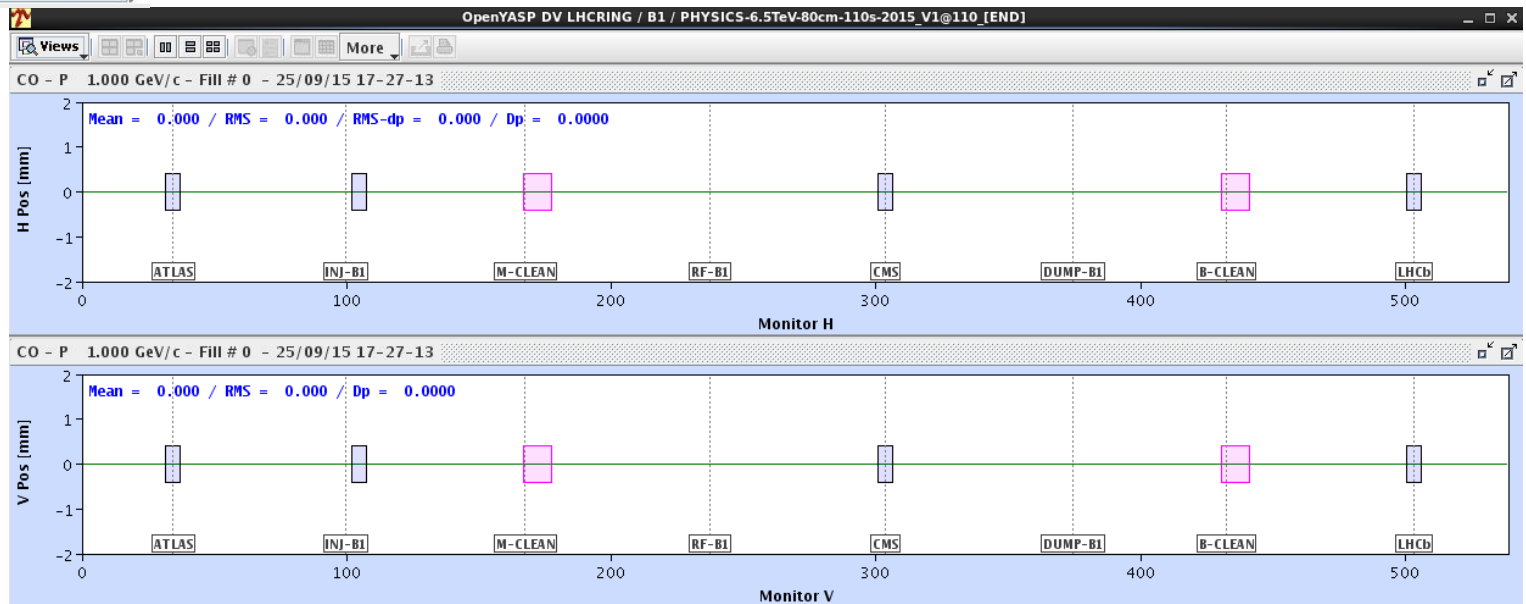
Orbit List

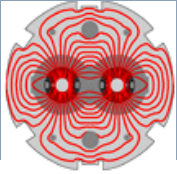
Ind	Id	Time	Scaling	Info
0	-1	0	1.000	0 - YASP orbit - 25/09/15 13-53-37
1		0	0.000	
2		0	0.000	
3		0	0.000	

Set current orbit as reference

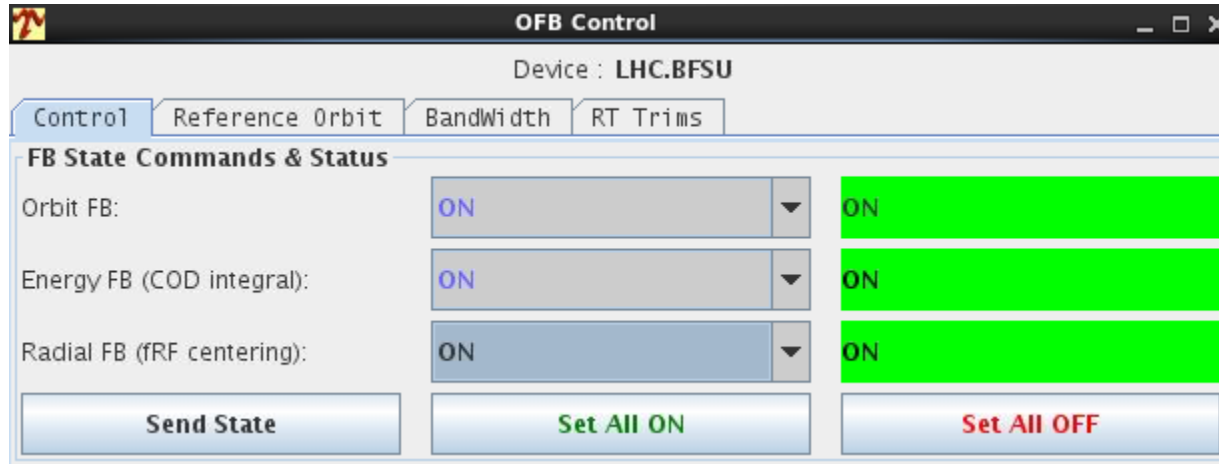


When the current orbit has been received by the OFC, the orbit difference with respect to FB ref. should jump to 0 since reference and actual orbit should be identical.
(during the transient of loading the reference, you may see a strange orbit for a few seconds – do not worry only the end result counts).

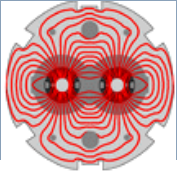




- Switch on ALL feedbacks !



- Note that the correction is very soft, you can optimize and perform OP scans with OFB ON ! The correction will not build bumps and will not remove the lumi knob bumps.
- Note: in case one BPM suddenly jumps by more than 3 mm, the OFB may switch off (automatic off). Deselect the BPM and switch back on.



- A sequence in the preparation for injection will reset the OFB configuration to the default values for injection, ramp and squeeze.

