

## continuation of characterization of the Spark-ERXR

first version of Spark-ERXR was tested to satisfaction (nearly 2 years ago)

i.e. compatible with ESRF requirements of :

- position stability (few  $\mu\text{m}$  drift over hours, or with 50% current change)
- High peak input signals (single bunch fillings)

However, this version was using different Analogue components (amplifiers & SAW filter) then the final version that the ESRF envisages to procure (140-150 units) this year for the extra BPMs in the *EBS*.

Also, the platform (chassis) is upgraded (still PoE) and the interface software (no longer SCPI, but Tango for the ESRF)

The SAW filters were doubled and RF circuit improved, yielding higher resolution.

But the final version (including the new SAW filters) was received only 2 weeks ago, and ESRF tests on this have not been done yet.

**Is an ESRF priority in the next weeks/months.**

That final version will also include the possibility to (software) select the sensitivity of the ADCs. This yields an extra 6 dB gain-switch on top of the 31dB of the RF-attenuators. Will be appreciated during the early (difficult) commissioning of EBS with low currents etc.

**discovery, and the subsequent statistics records,  
of the behavior of jumping amplitudes in Libera Brilliance**

Recall : - presently we operate 224 **Libera-Brilliances**

- *EBS* needs total of 320 BPMs :

- 192 will re-use **Libera-Brilliances**  is obsolete, so we  
create extra (32) spares

- 128 will be equipped with Spark-ERXR

so we keep a vigilant eye on our park of **Libera-Brilliance** since  
orbit measurement and stability depend on it in the future

discovery of “**jumping amplitudes**” :

The **RF-multiplexing concept** in the Liberas provides an active & permanent compensation of any relative gain **drifts** (slow) between the 4 channels. It is a key element in providing the **stability** of beam-position measurement.

This RF multiplexing is typically done around 13KHz, this is above the FA frequency (10KHz) and with dedicated notch filters etc. in the FA chain this 13KHz interference is removed.

It can not be removed from higher bandwidth outputs (buffers) like the T-b-T (>100KHz), But spikes and steps (in T-b-T data) that this RF-switching causes are minimized by applying the **DSC coefficients** that the Libera calculates itself permanently.

DSC coefficients are 4 values of amplitudes and 4 of phases, and concern these 4 RF-channels. They are calculated and (if needed, i.e. drift) re-applied at 12 sec period.

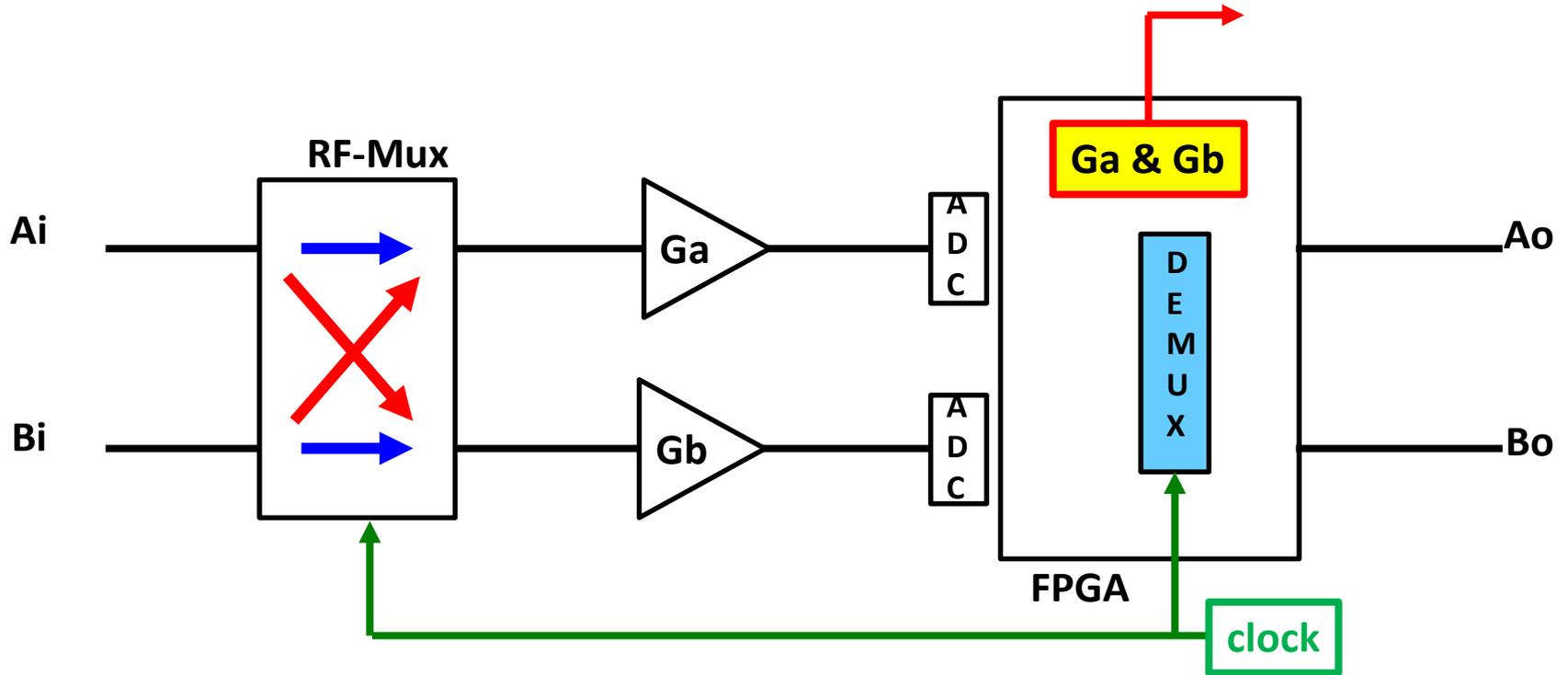
i.e. a Libera unit may have amplitude coefficients like : **1.03 0.99 0.99 0.99**

They may drift, but it will not affect the stability of the BPM data.

At the ESRF we are (since January 2017) storing these 4 coeffs. at 10sec interval.

We observe that among our 224 units a certain number produce **sudden jumps** of these values.

# principle of internal calibration of a Libera (2 channels only)



## discovery of “jumping amplitudes” :

Monitoring these 4 DSC coefficients (and their jumps) is the easiest way of taking note of this problem,

but at the ESRF we got first track of this behavior by : our FOC switching-off ...  
(done automatically if it has to make a too abrupt correction)

This FOC going-off was (at some period last December) often caused by the same unit, so we focused on that unit :

- analyzing the FDA data,
- triggering the PM-buffer (at the moment of FOC going off) → analyzing the PM T-b-T data
- operating it with the DSC daemon OFF

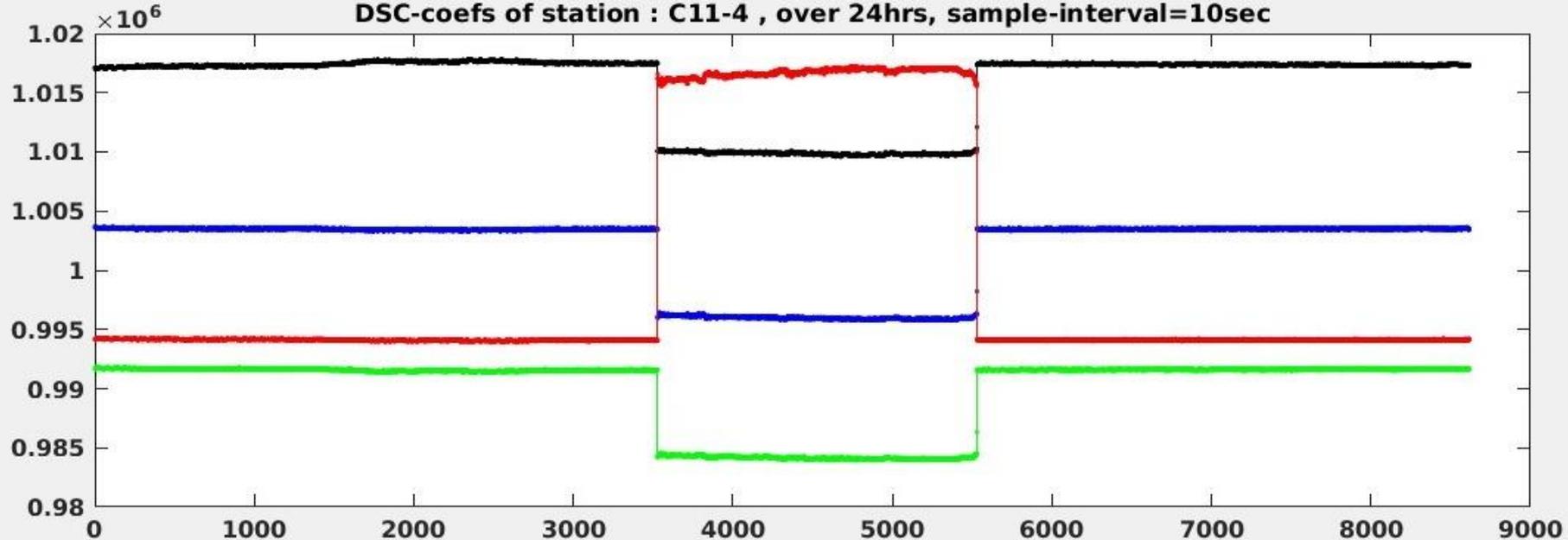
This lead to the conclusion that the DSC itself works properly, i.e. it does what it has to do.

But : the jump (of the DSC coeffs.) comes from a real sudden jump in the amplitude of a channel as if the gain of such channel suddenly changed by typical 2 to 20% (+ or -)

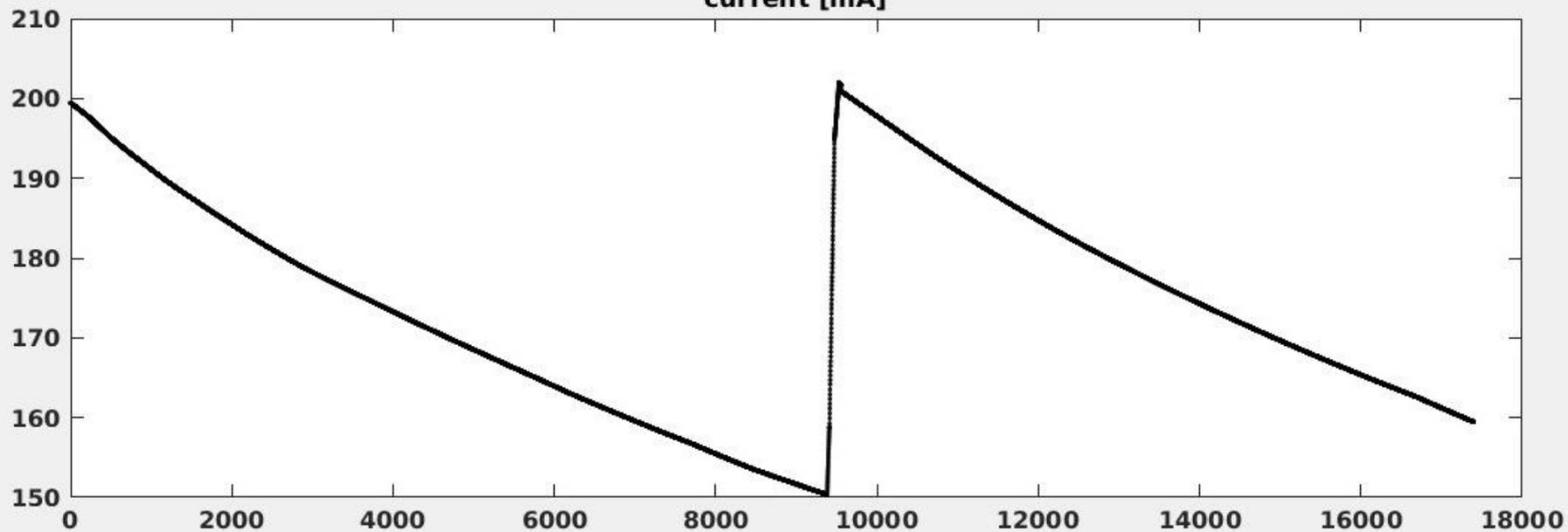
(stress : input signals from BPM-buttons are NOT at cause)

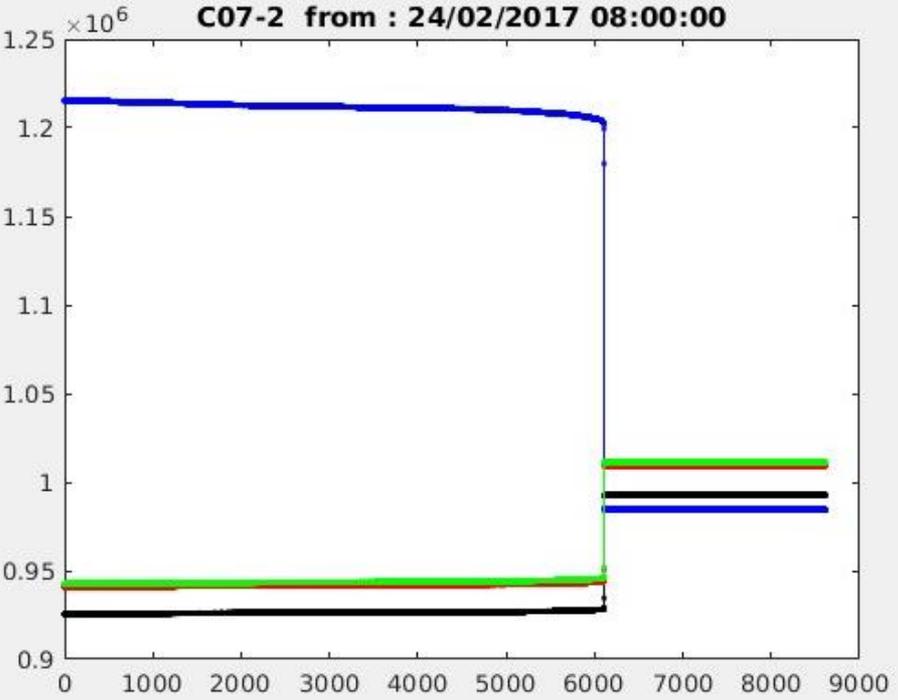
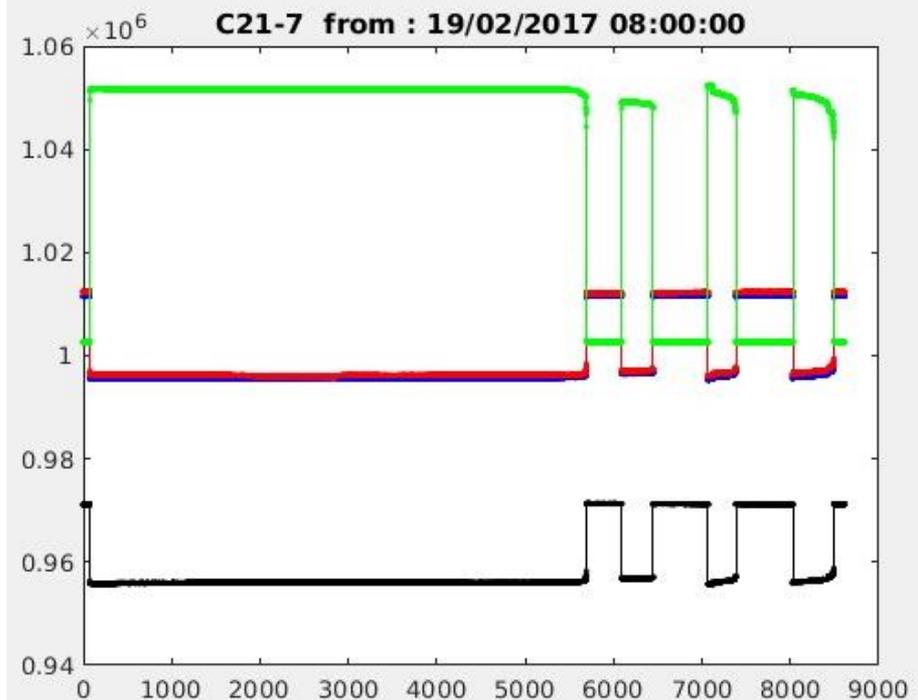
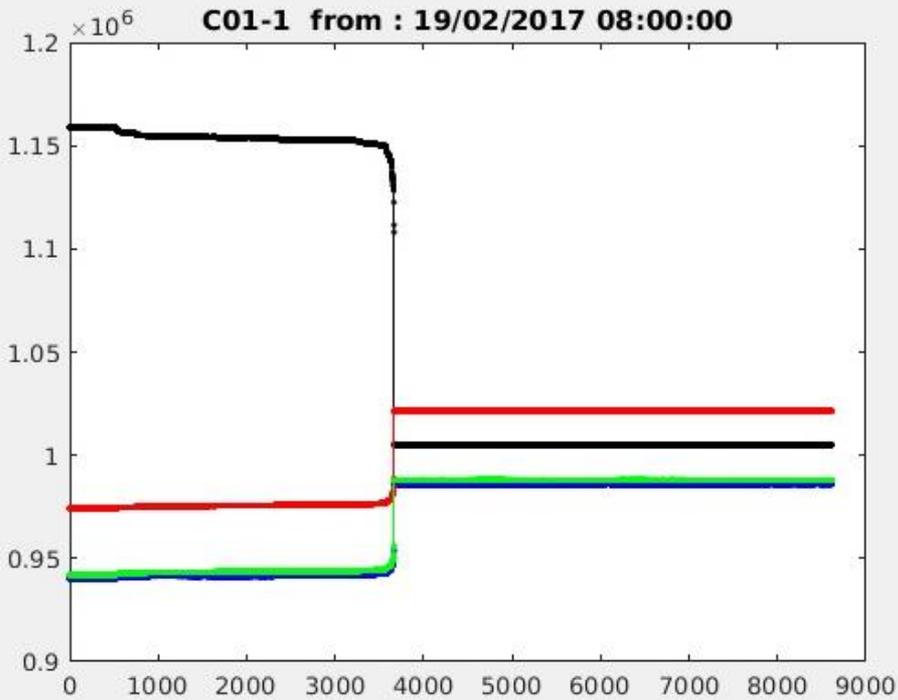
illustrations :

DSC-coefs of station : C11-4 , over 24hrs, sample-interval=10sec



current [mA]





**3 examples, recording=24hrs, 10 sec interval**

about 10% of our park (224) is (more or less) affected

but not all in the same way :

- some have regular jumps, some only 1 per week ...
- the amplitude is also very different <1% >20%
- which channel

also : a power-off-on can cure (for a while) this behavior

what we worry about : is it an ageing effect and will it grow ?

- affecting progressively more units ?
- jumps getting more frequent and stronger in amplitude ?

what is the consequence for the BPM data ? (when running FOC with FA data)

SA-data : virtually none

FA-data : a **short spike**, followed by **oscillations** for max. 12 sec



**too short to leak into  
your orbit, but may  
switch-off the FOC**



**at freq. values defined by  
your Libera decimation, etc.  
can be in your FOC bandwidth,  
thus leaking into your orbit ...**

## **actions underway :**

**ESRF :** follow-up this behavior, and build-up statistics :  
asses if it grows (or not)

**I-Tech :** 2 worst stations under analysis,  
to find the real (hardware) cause of a jump

**other Libera users :**

can you store the 4 DSC (amplitude) coefficients (at 10sec interval) ?  
and check if you see “jumps” ?