

Status of the BPM system at the ESRF

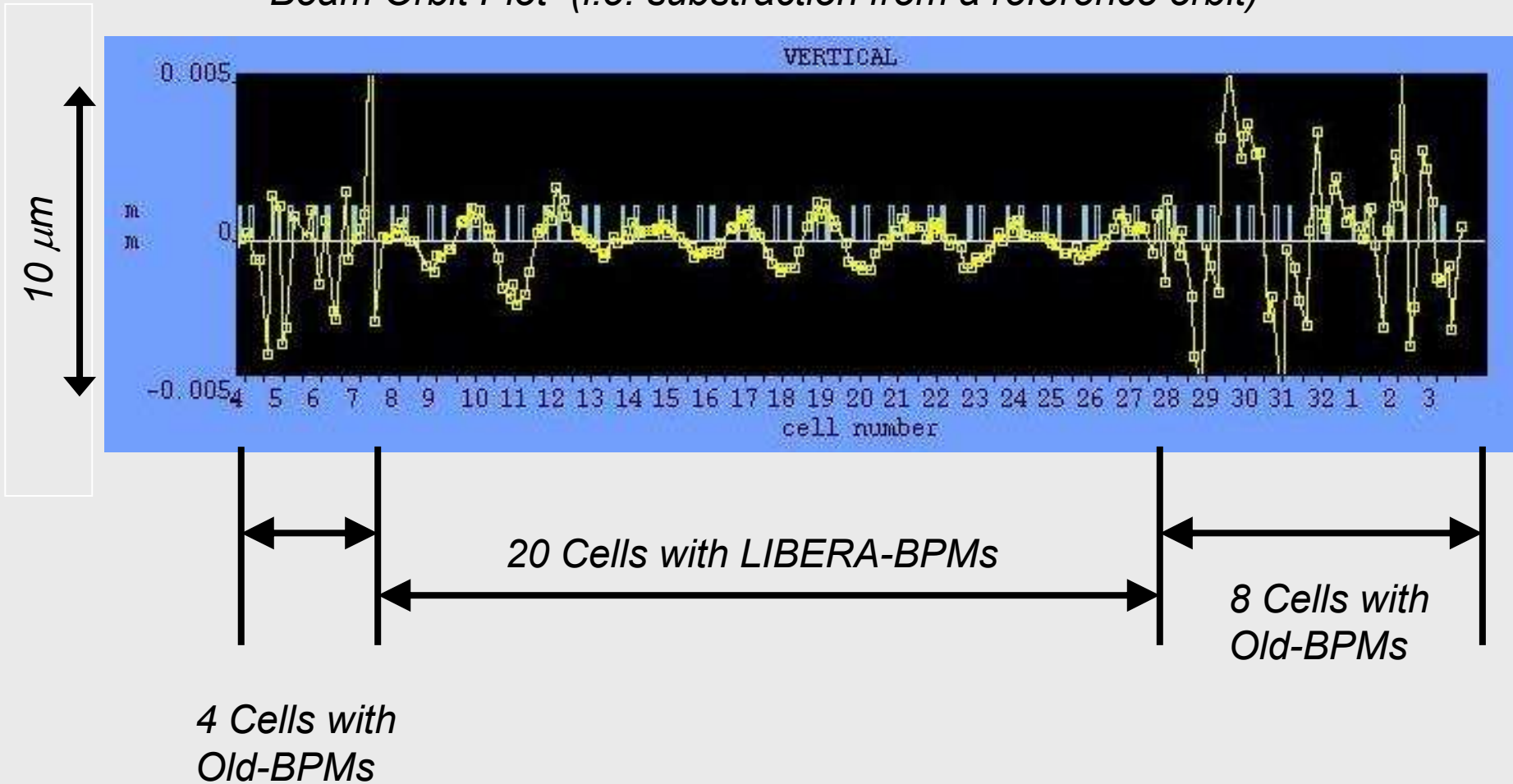
Friederike Ewald

on behalf of Kees Scheidt, Francis Epaud, Benoît Joly

- *What is new / status*
 - *Software*
 - *Hardware*
 - *TbT commissioning*
 - *Fast orbit control*
- *Sum signals for life-time measurement*
- *First experience with optimised Libera Brilliance Single-Pass :*
 - *injection efficiency measurements*

an intermediate view ...

Beam Orbit Plot (i.e. subtraction from a reference orbit)



Liberas in the ESRF

224 Liberas in the Storage Ring

soon: 5 BPM Libera Brilliances in **Booster**

→ for machine studies

Tests for charge-transfer measurement

→ Striplines + Libera Brilliance Single Pass

→ if successful: installation in

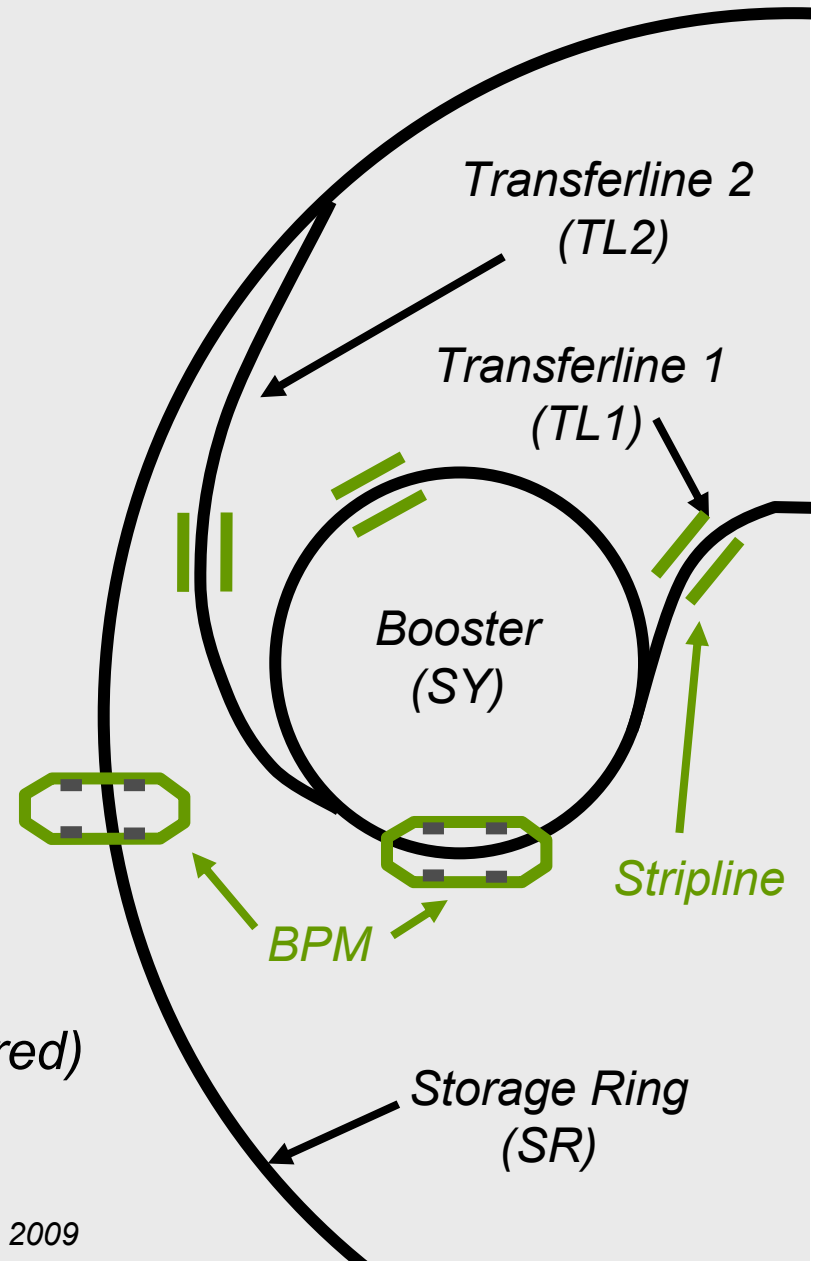
TI1 & SY & TL2

Software

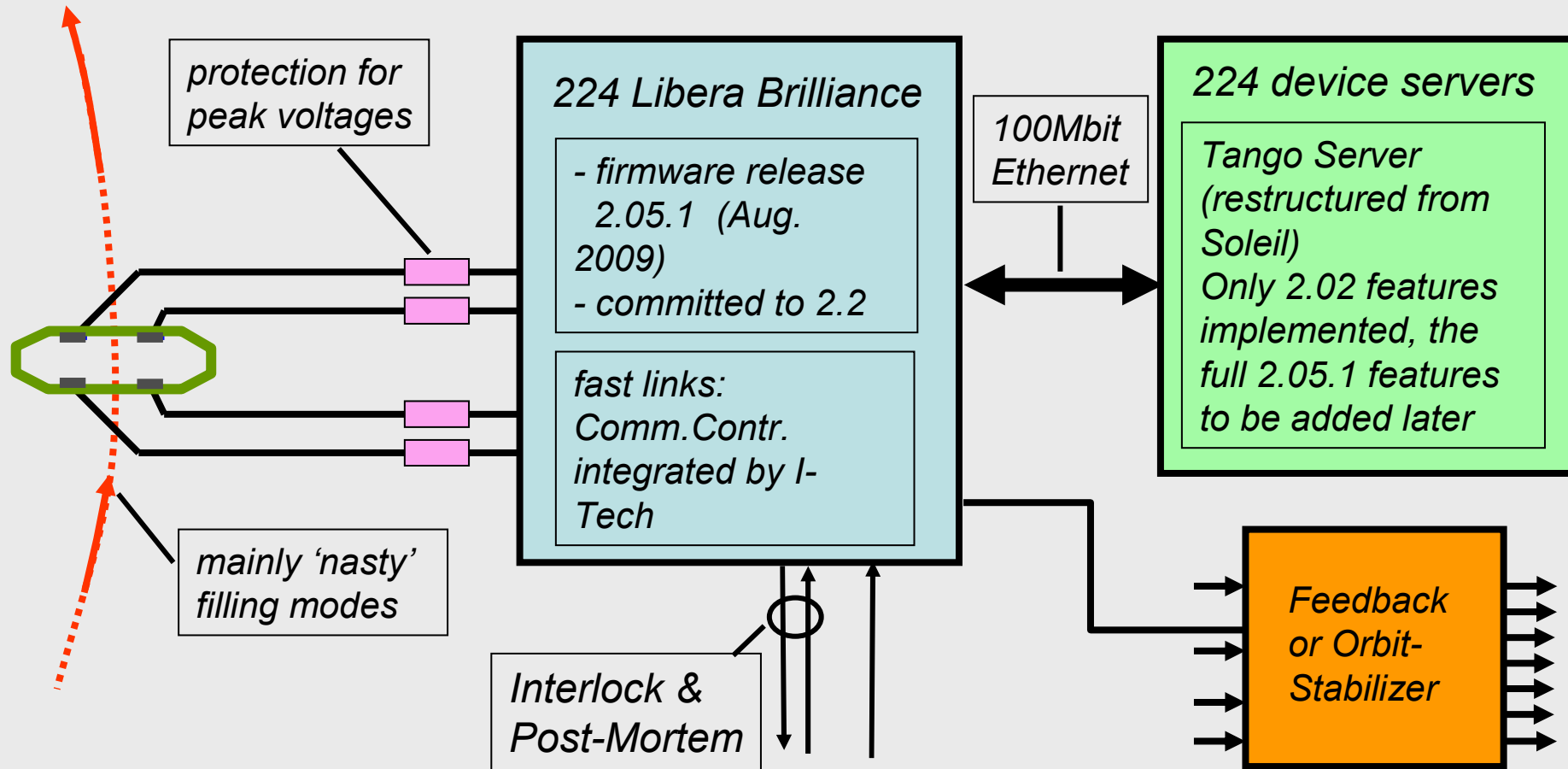
→ firmware release 2.05.1 (Aug. 2009)

→ committed to 2.2

→ Server : Tango ("Soleil" server restructured)



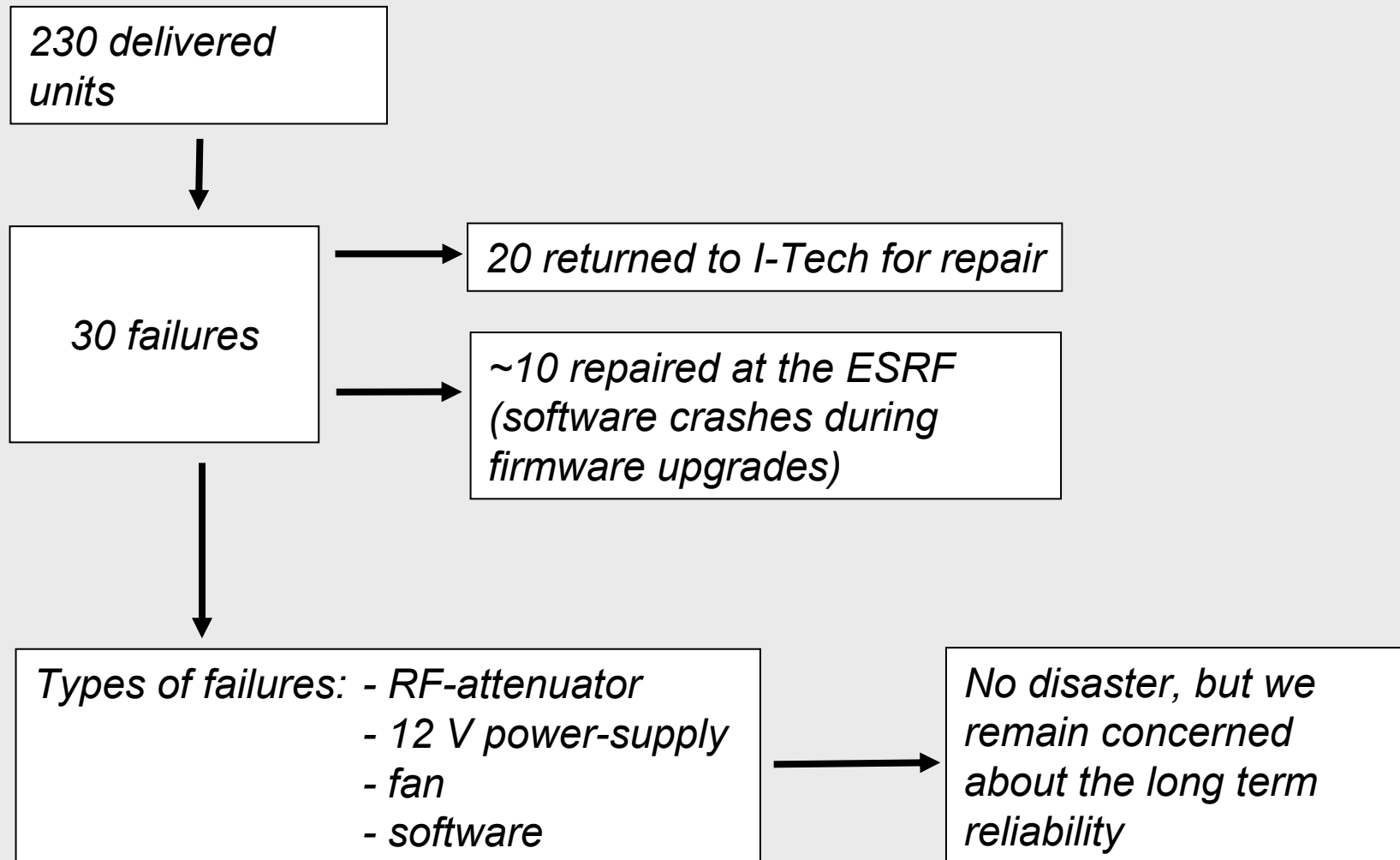
The ESRF Storage Ring BPM system



224 Libera Brilliance (32 cells x 7 BPMs)

- Closed Orbit measurement and slow Orbit Correction
- TbT capability has been tested and is close to be fully commissioned
- the FA (10KHz) distribution is in progress of commissioning

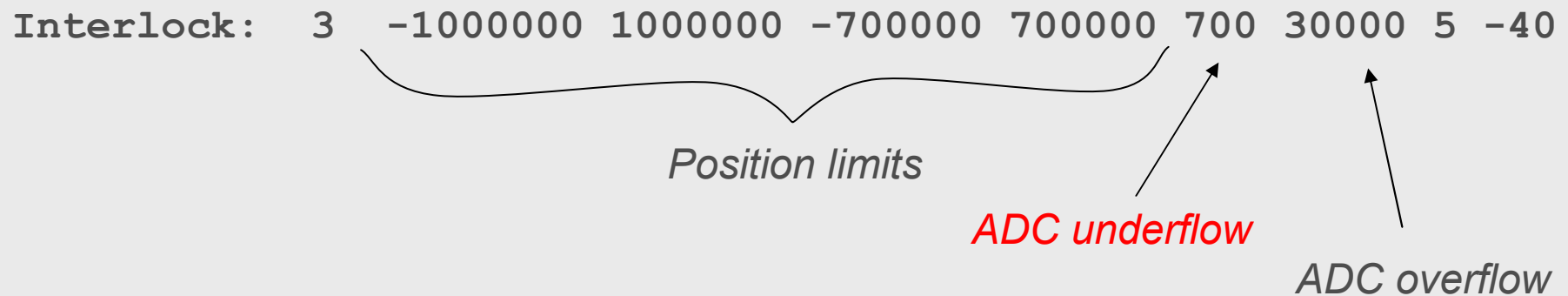
Status of failure rate (Sept 2009, 9 month after delivery)



Software

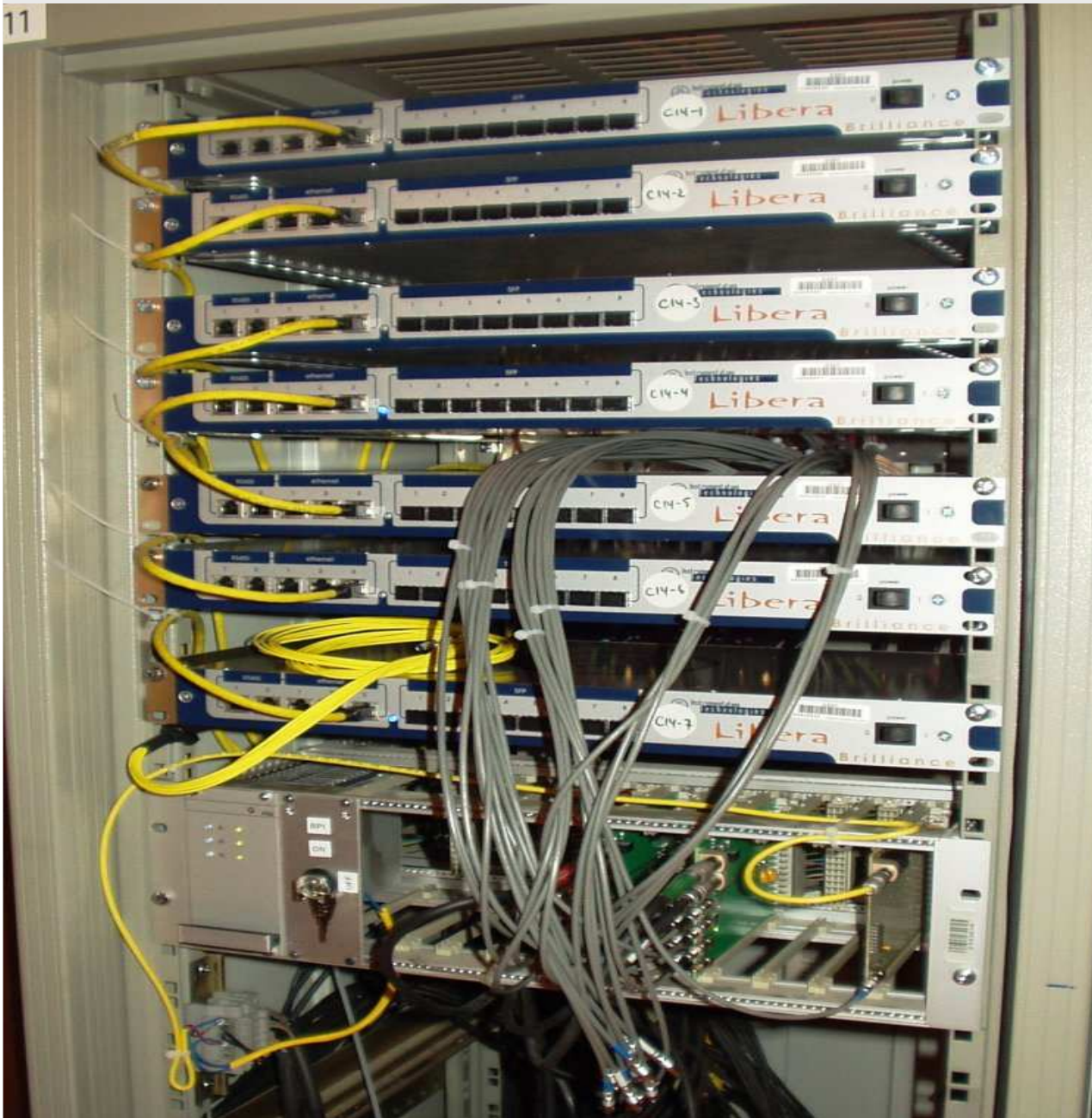
Latest software patch 2.05.1 installed (end of August 2009)

→ *additional beam interlock feature for the ESRF
(ADC ,underflow' limit) :*



→ *speed control for too slow fans implemented*

Temperature regulation



Too HOT!

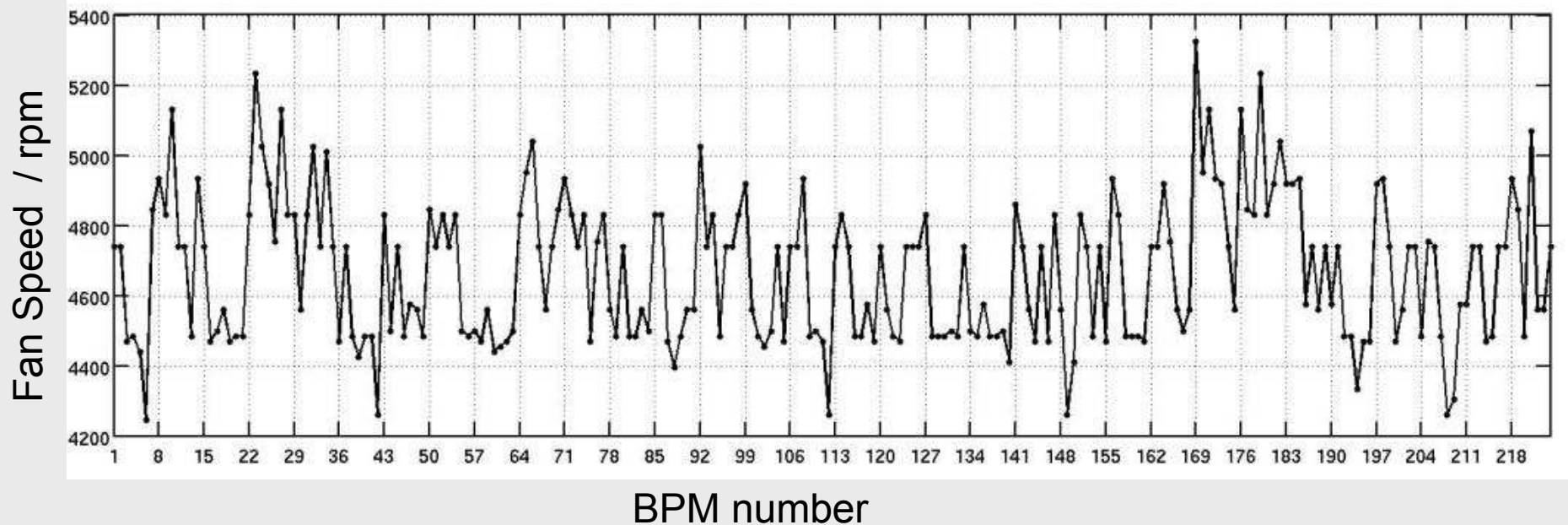
HOT!

WARM

Temperature and fan speed control

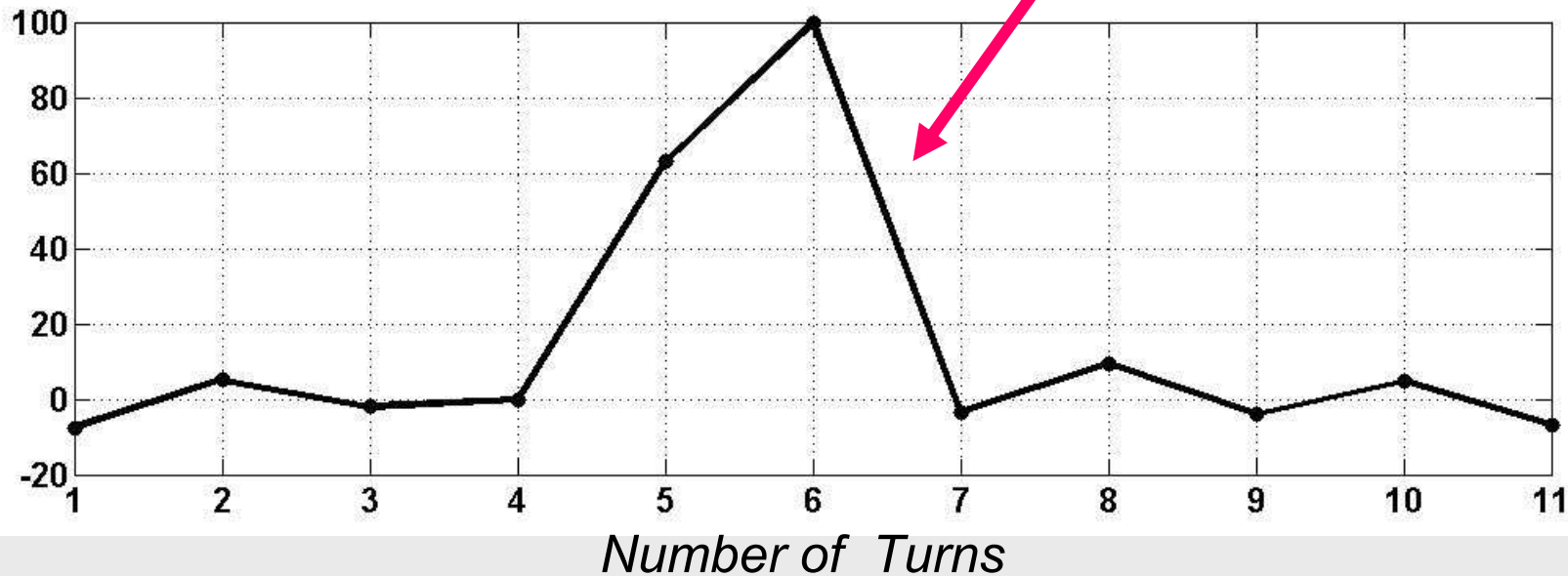
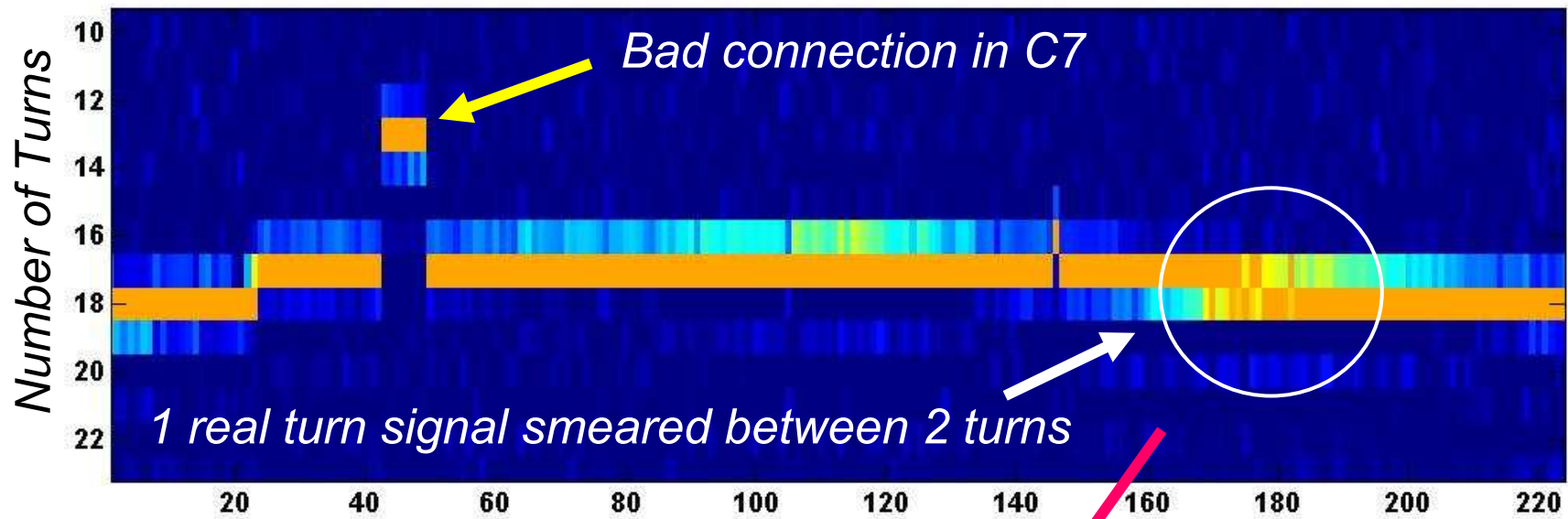
- *additional fans & doors*
- *2.05.1 patch regulates 'under-speed' problem*

→ *All fan speeds now between 4200 – 5400 rpm*

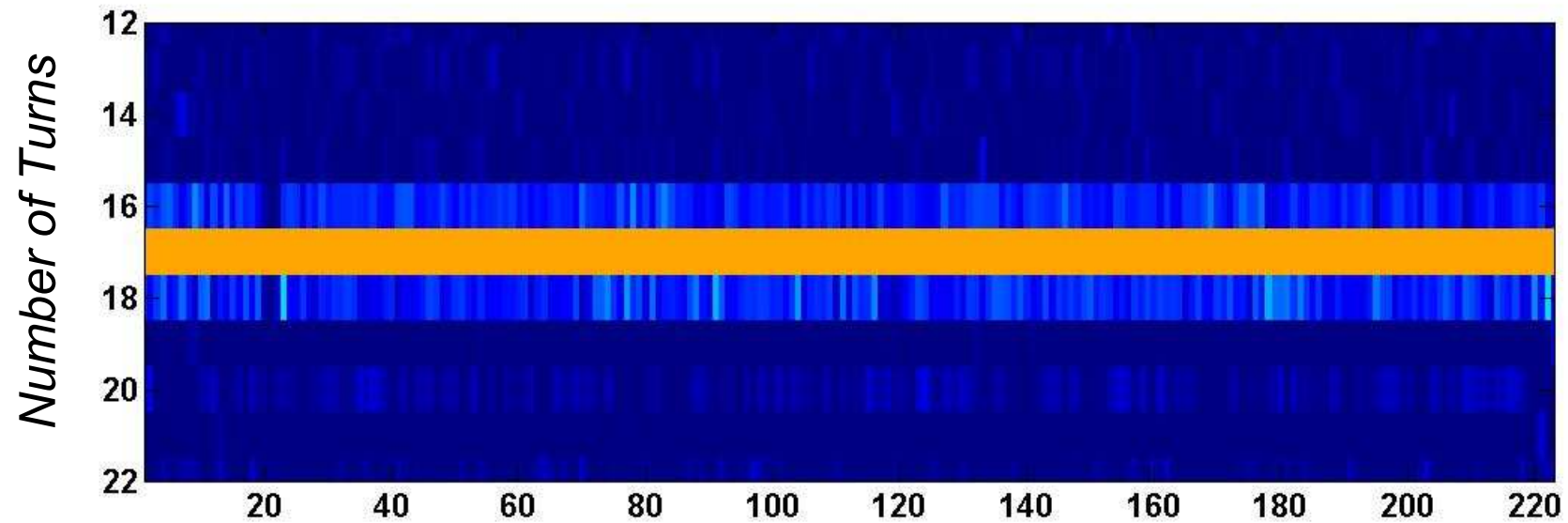


Turn by turn synchronisation

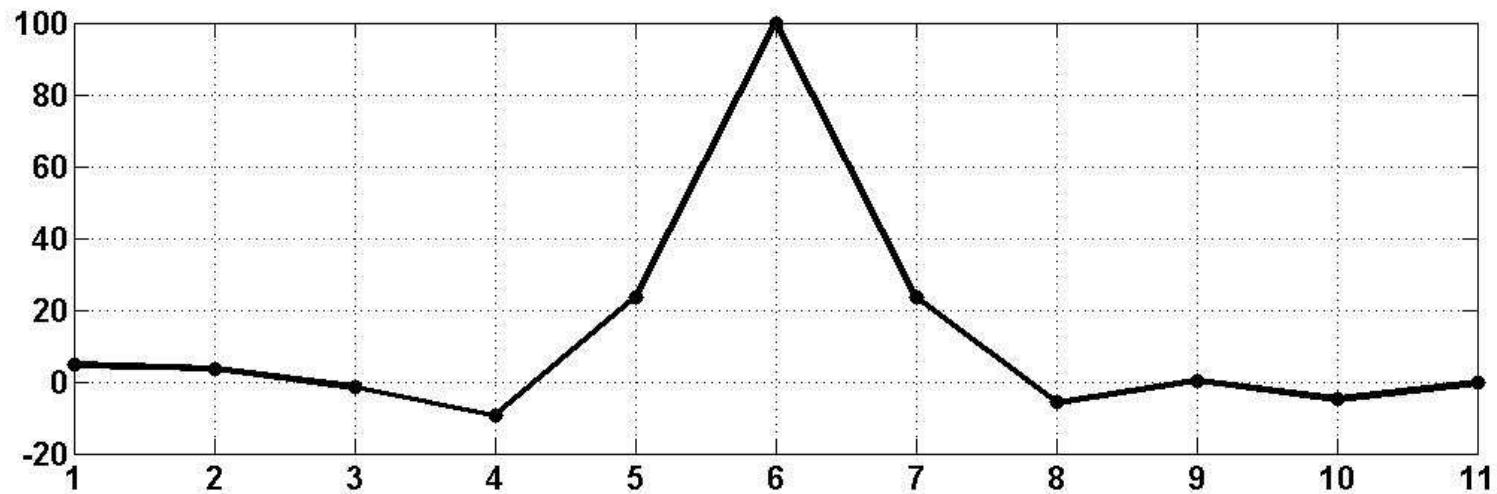
Turn by turn synchronisation



Turn by turn synchronisation



Close to perfect for the standard DDC filter



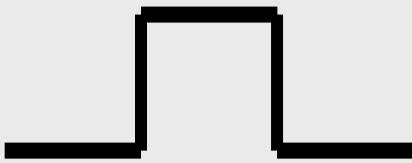
Number of Turns

Libera Workshop 18. Sept. 2009

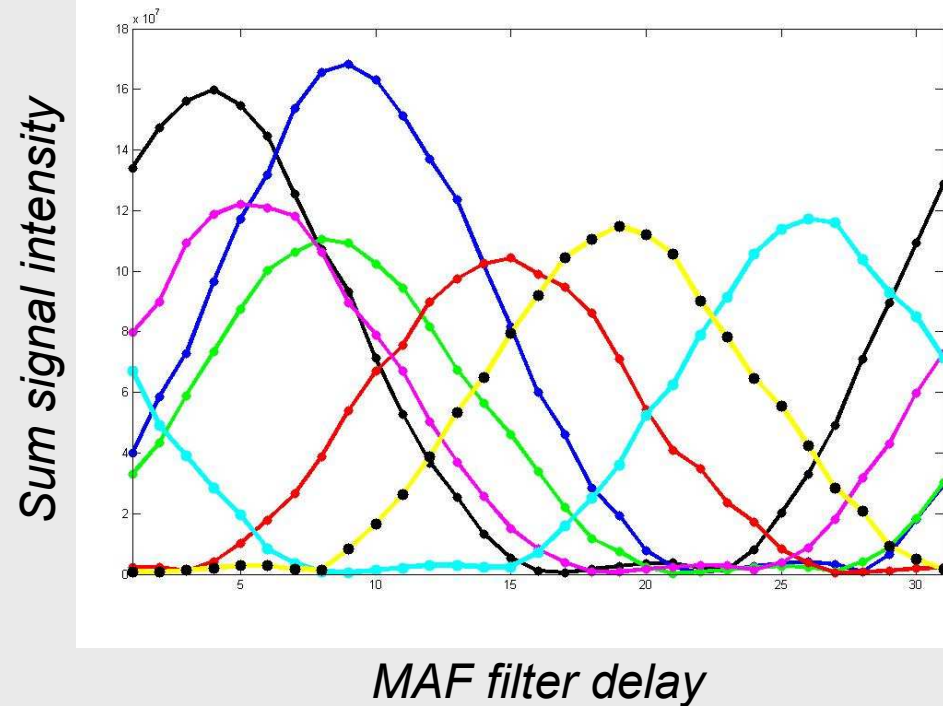
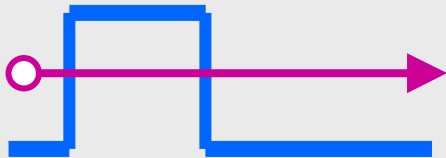
MAF filter synchronisation

Time-Scanning of the MAF Filter synchronization with the 1/3 fill

Beam (1/3 filling)



Filter



Status :

tested on a few cells, soon to be tested on all, and then use in real beam physics application

10 kHz fast orbit stabilisation

10 kHz fast orbit stabilisation

Data communication in the process of being commissioned

→ Still some problems with:

- „Software“ and „Frame“ errors in the Communication Controller*
- connection problems ?*

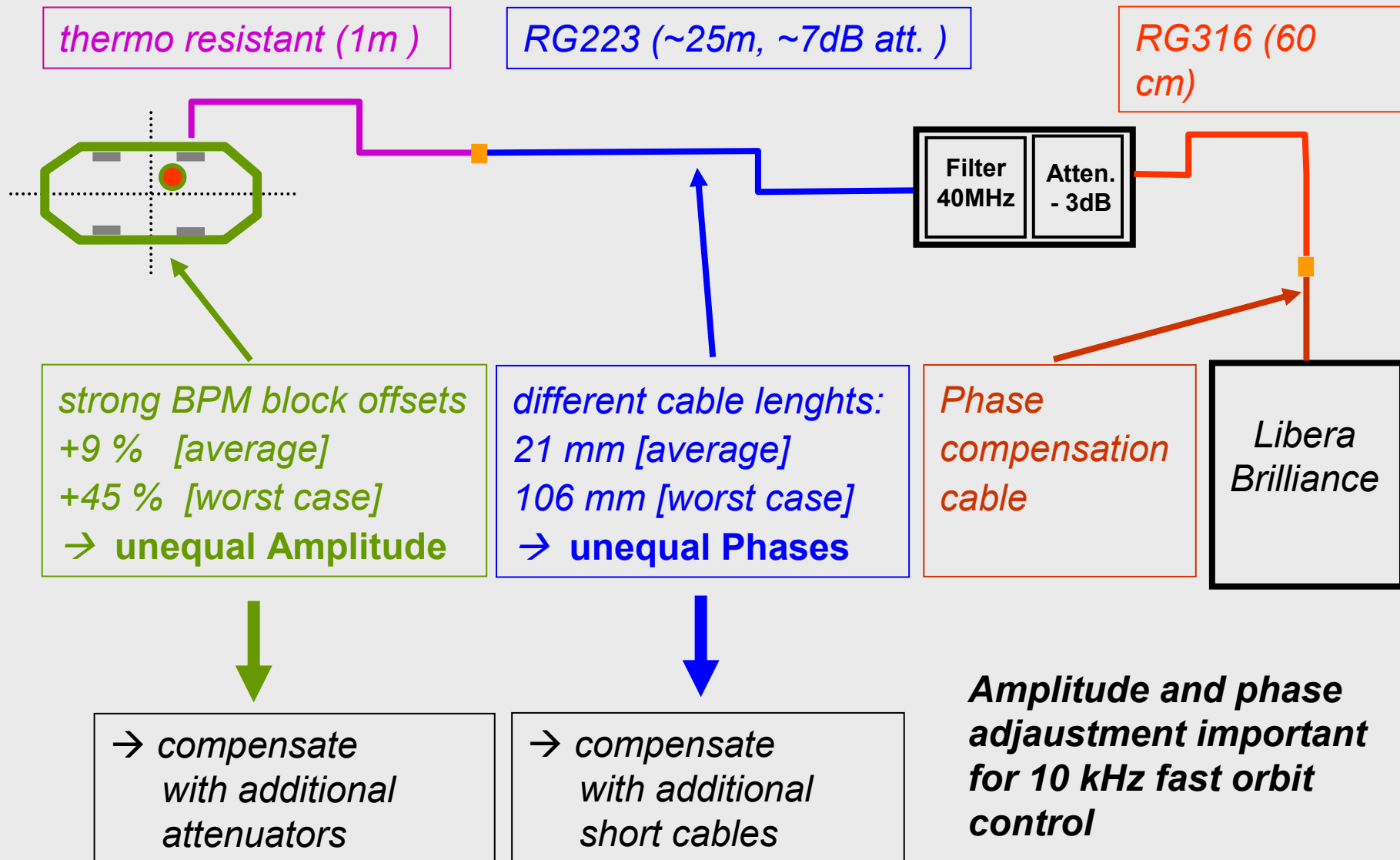
→ To do:

→ connect and test all cells

→ Amplitude and phase differences from electrodes to be compensated

→ power supplies for corrector magnets

RF amplitude and phase compensation

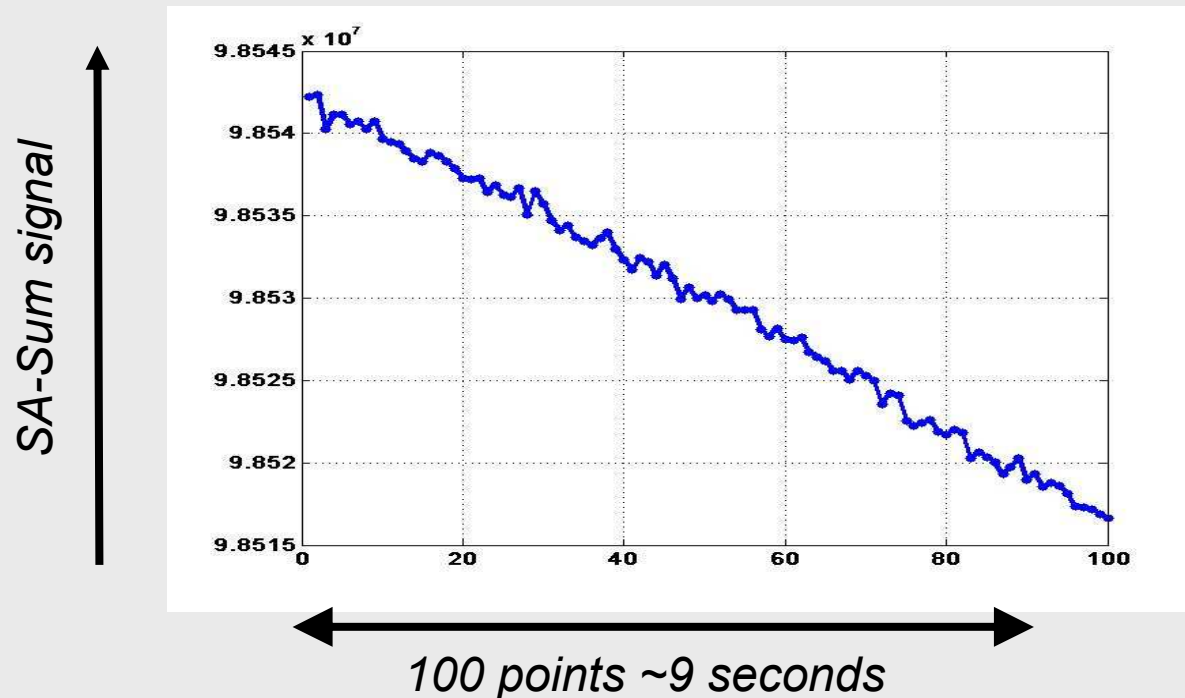


Life time measurement

Life time measurement

4 x 10mA fill :

The Sum signal of an individual Libera is (for low beam currents) much more stable than the DDCT (PCT) current monitors

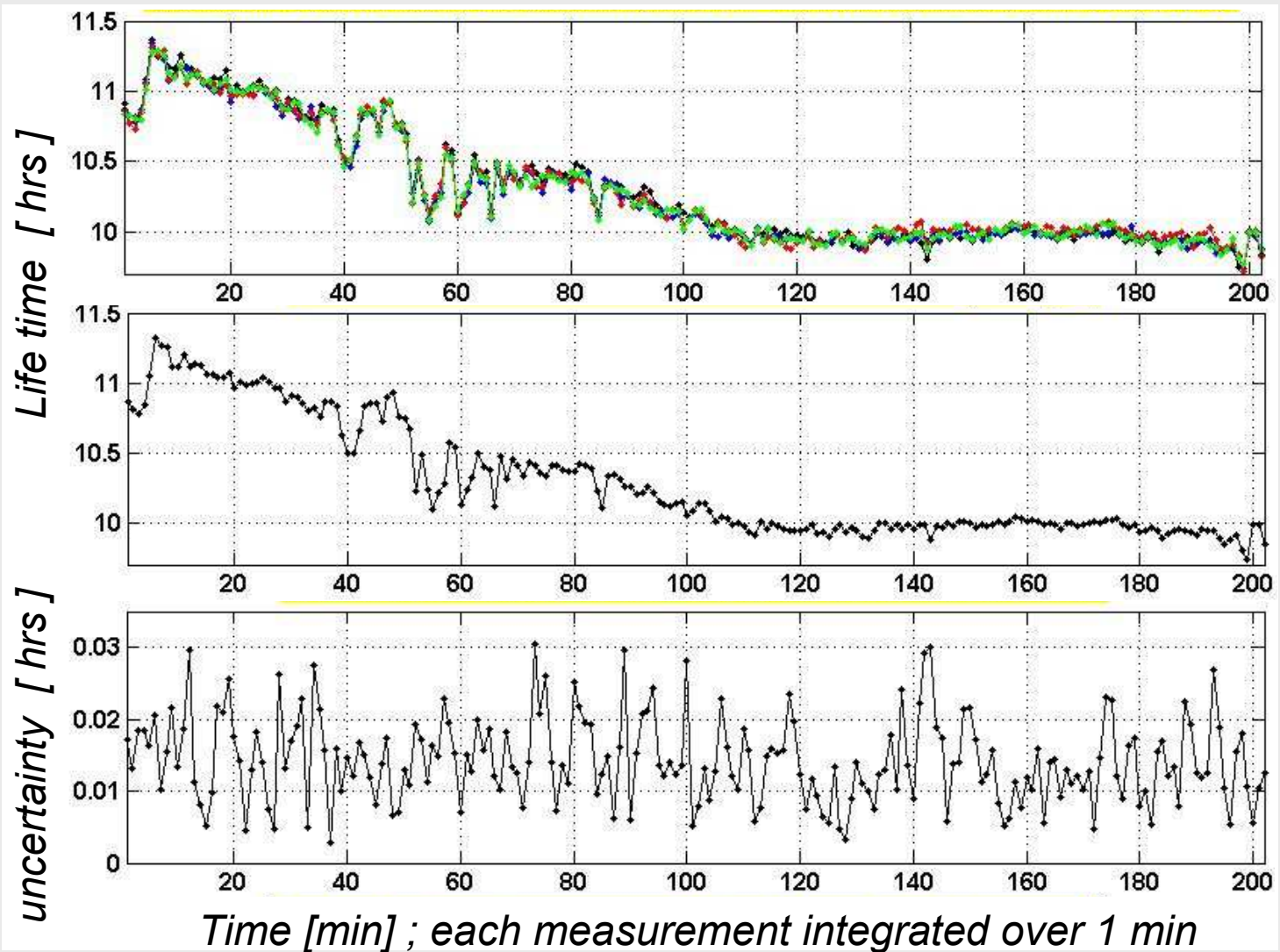


→ SA-Sum signal of all Liberass → precise and fast Life-Time measurements from each Libera

→ In next software version life time measurement included ?

Life time measurement (4 bunch filling)

Life time
derived from 4
x 56 Liberass

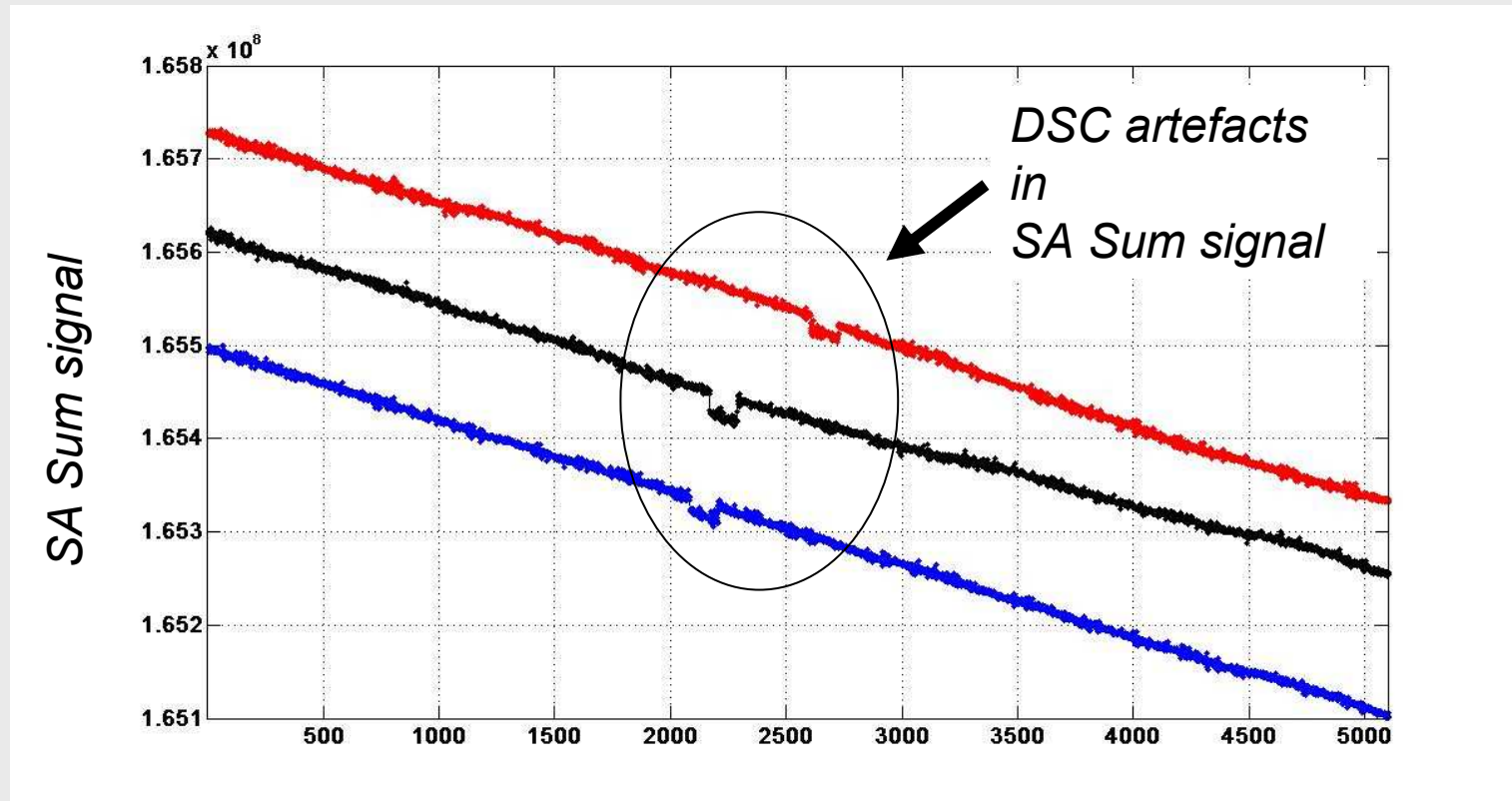


Life time
derived from all
224 Liberass

Uncertainty of
life-time.
Average :
0.014 hrs

Anomalous stations will rapidly show-up → different way of checking BPM signals

DSC switching artefacts



The present DSC mechanism causes certain 'jumps' in the SA sum signal

An optimization of the DSC shall hopefully suppress these

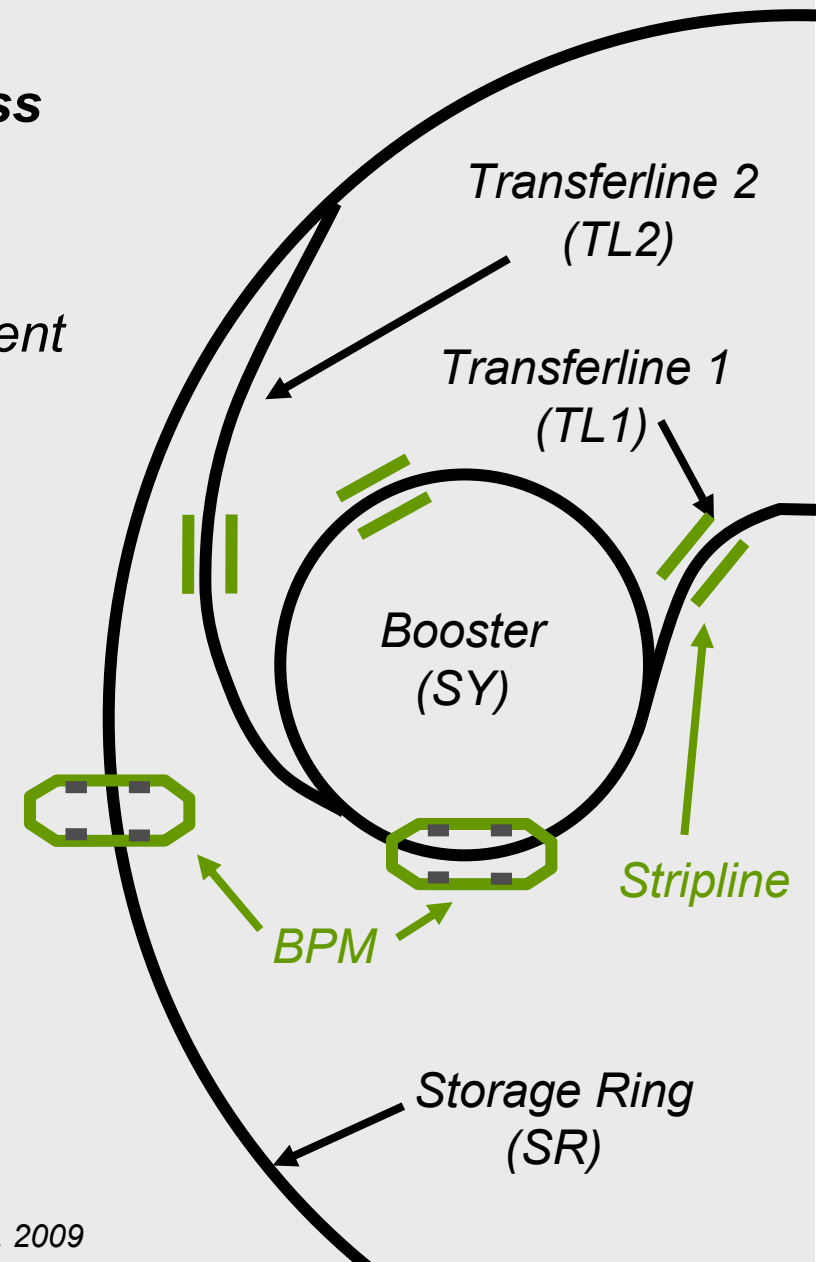
Charge transfer efficiency

Charge transfer efficiency

→ Striplines + **Libera Brilliance Single Pass**

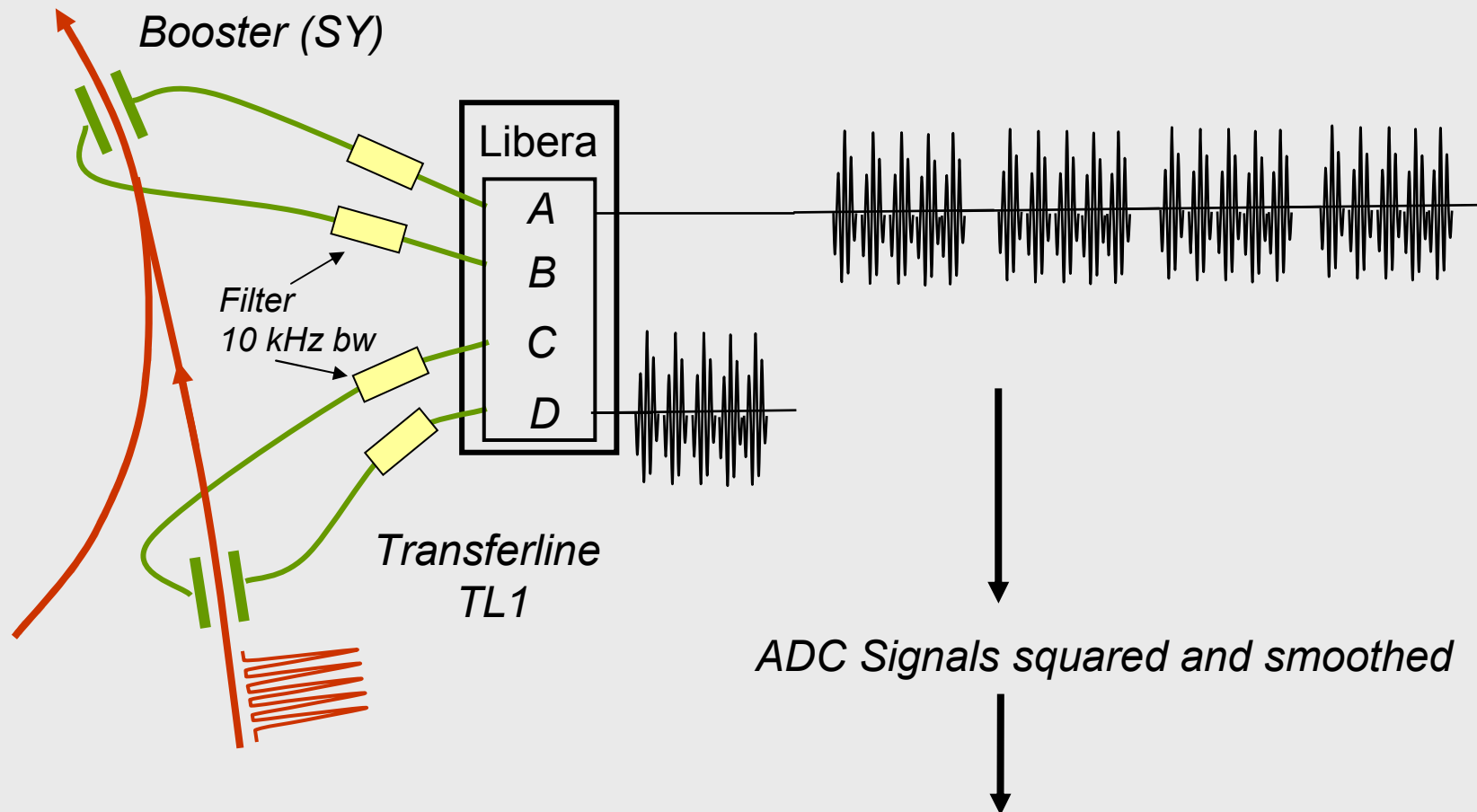
→ Tests for charge transfer measurement

→ if successful: installation in
TI1 & SY & TL2



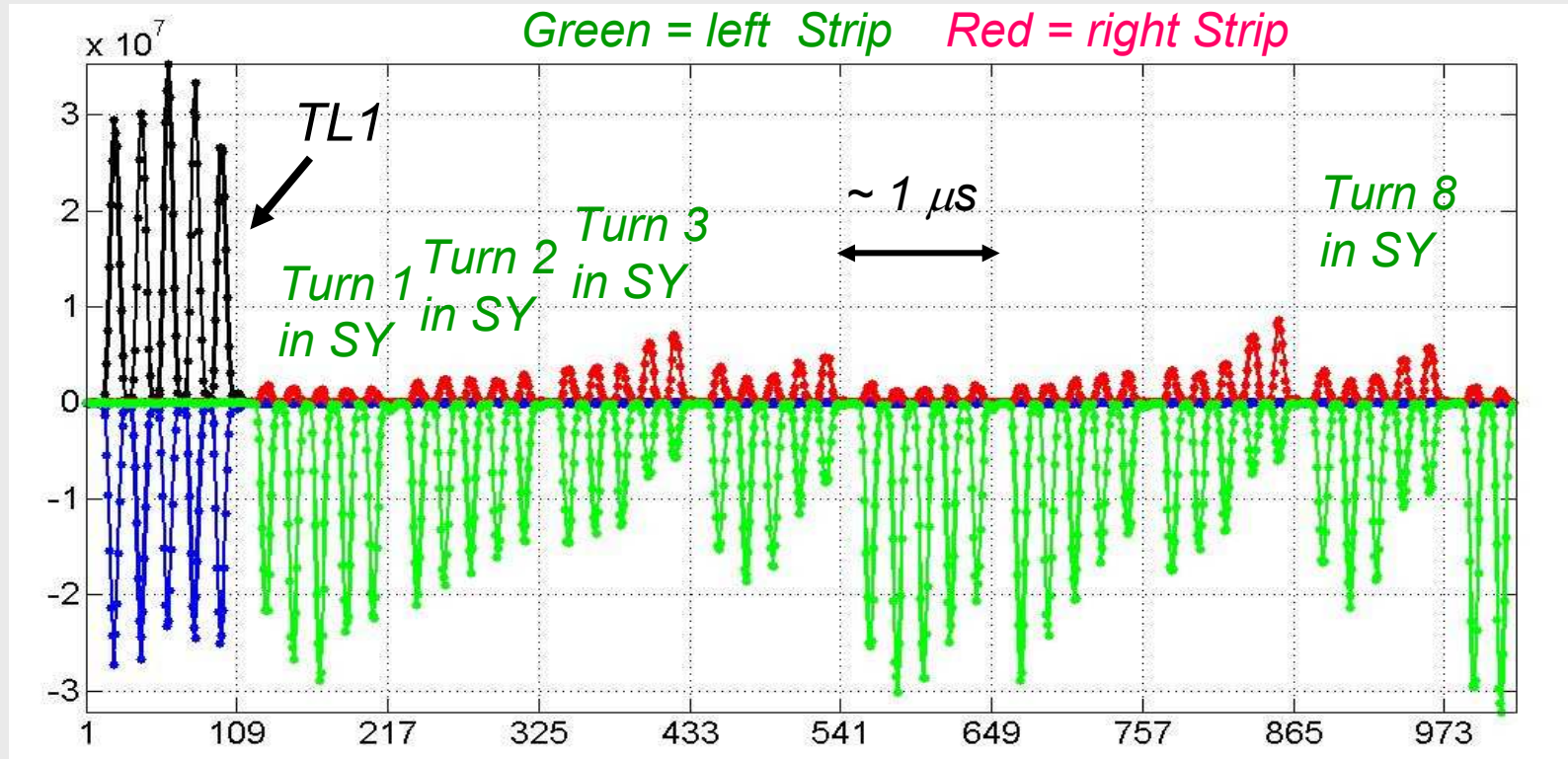
Charge transfer efficiency: Example TL1 \rightarrow SY

- 5 bunches with $\Delta t = 176$ ns injected:
- Signals from $\frac{1}{4}$ wavelength (352MHz) striplines in TL1 and SY
- Detection by Libera Brilliance Single Pass (without SAW filters)



Charge transfer efficiency: Example TL1 \rightarrow SY

squared and smoothed ADC data



Charge transfer efficiency: Example TL1 → SY

- *Using exclusively the ADC readings*
Allows to measure complicated bunch structures
- *Signals from ADCs are big*
Beam current measurement from a single pass (!) of a $1\mu\text{s}$ bunch as precise as DCT measurement in the Booster (50000 turns in 50 ms !).
Tested down to $< 0.2\text{ mA}$ bunch charge.
- *Very good reproducibility ($< 1\%$)*
Tested with the storage ring beam
- *May become complementary injection efficiency monitors in the ESRF injector complex*

