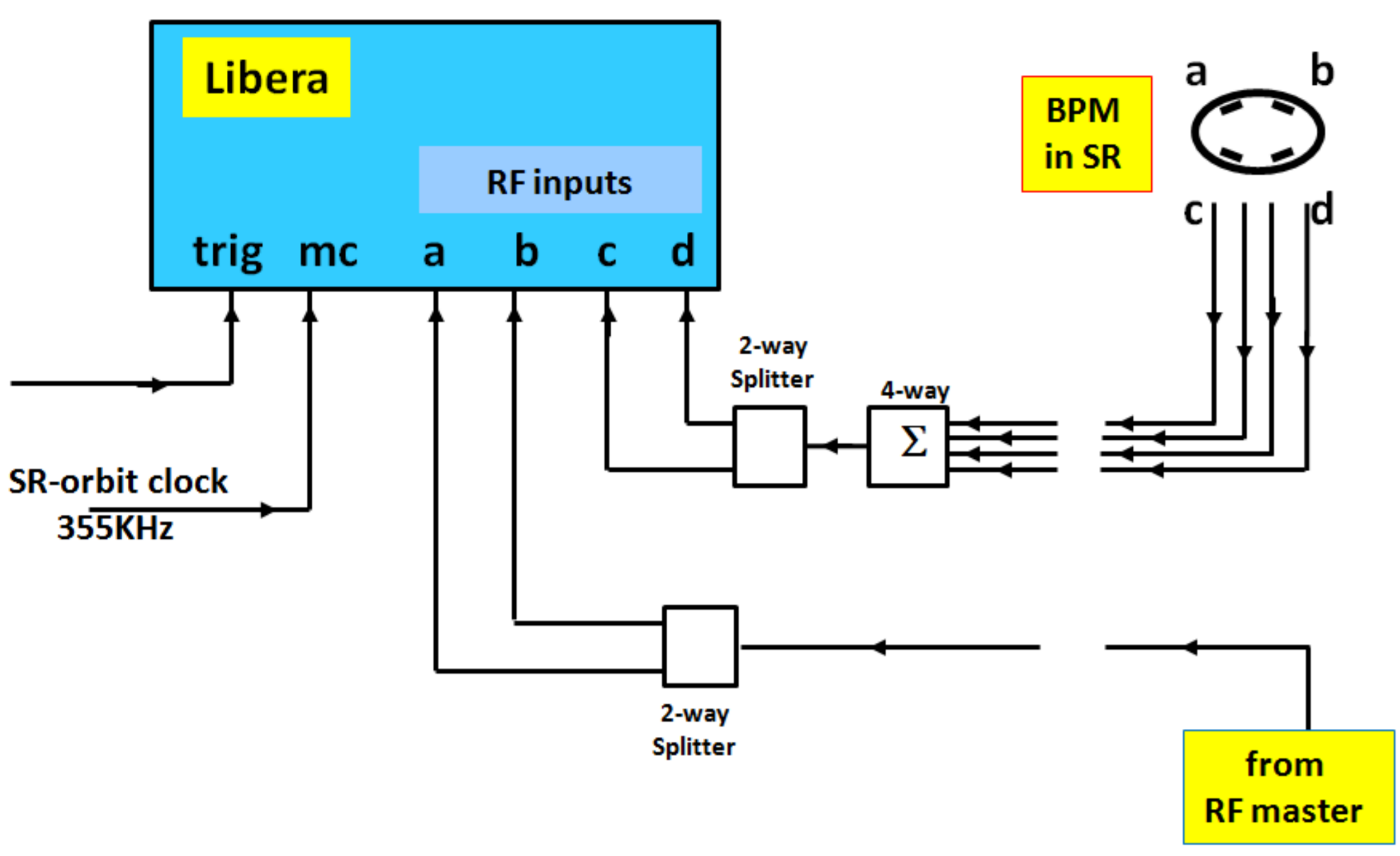# Upgrade of Beam Phase Monitors
for the ESRF Injector and Storage Ring
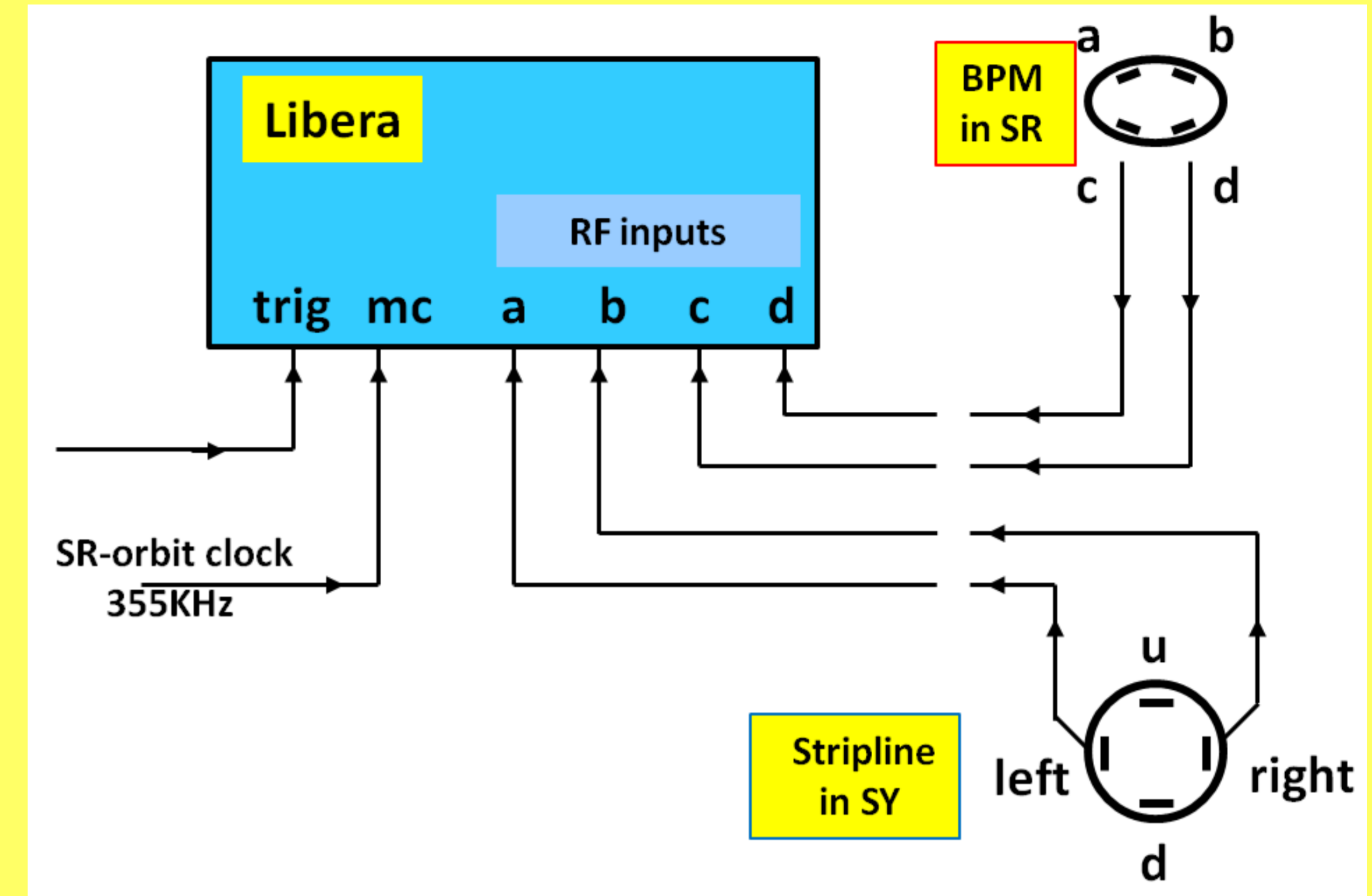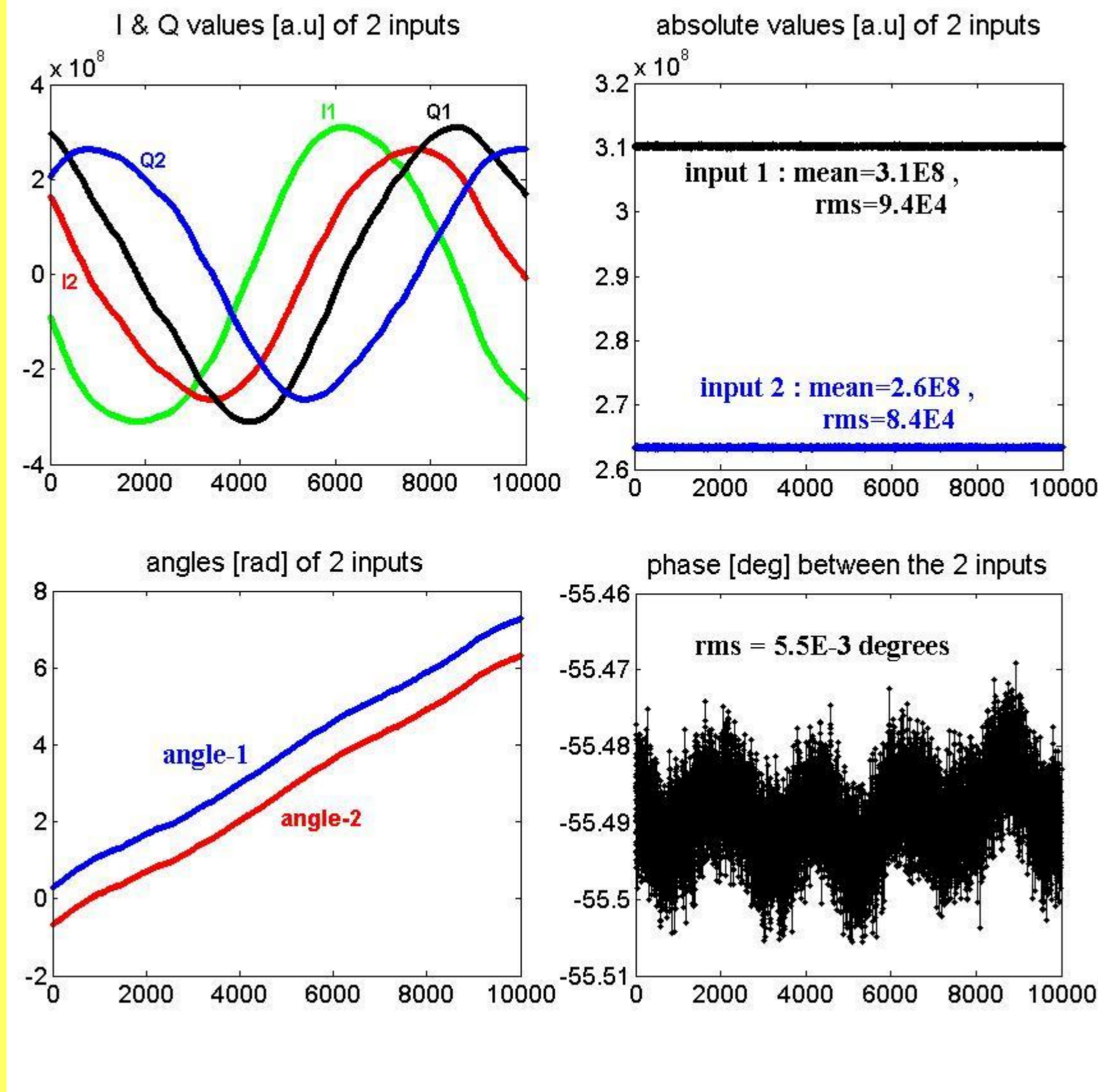
Kees SCHEIDT,   Benoit JOLY,

Diagnostics Group, Accelerator & Source Division, ESRF , Grenoble, FRANCE

ESRF

Libera
RF inputs
trig mc a b c d

BPM in SR
a b c d

2-way Splitter
4-way Σ

SR-orbit clock 355KHz

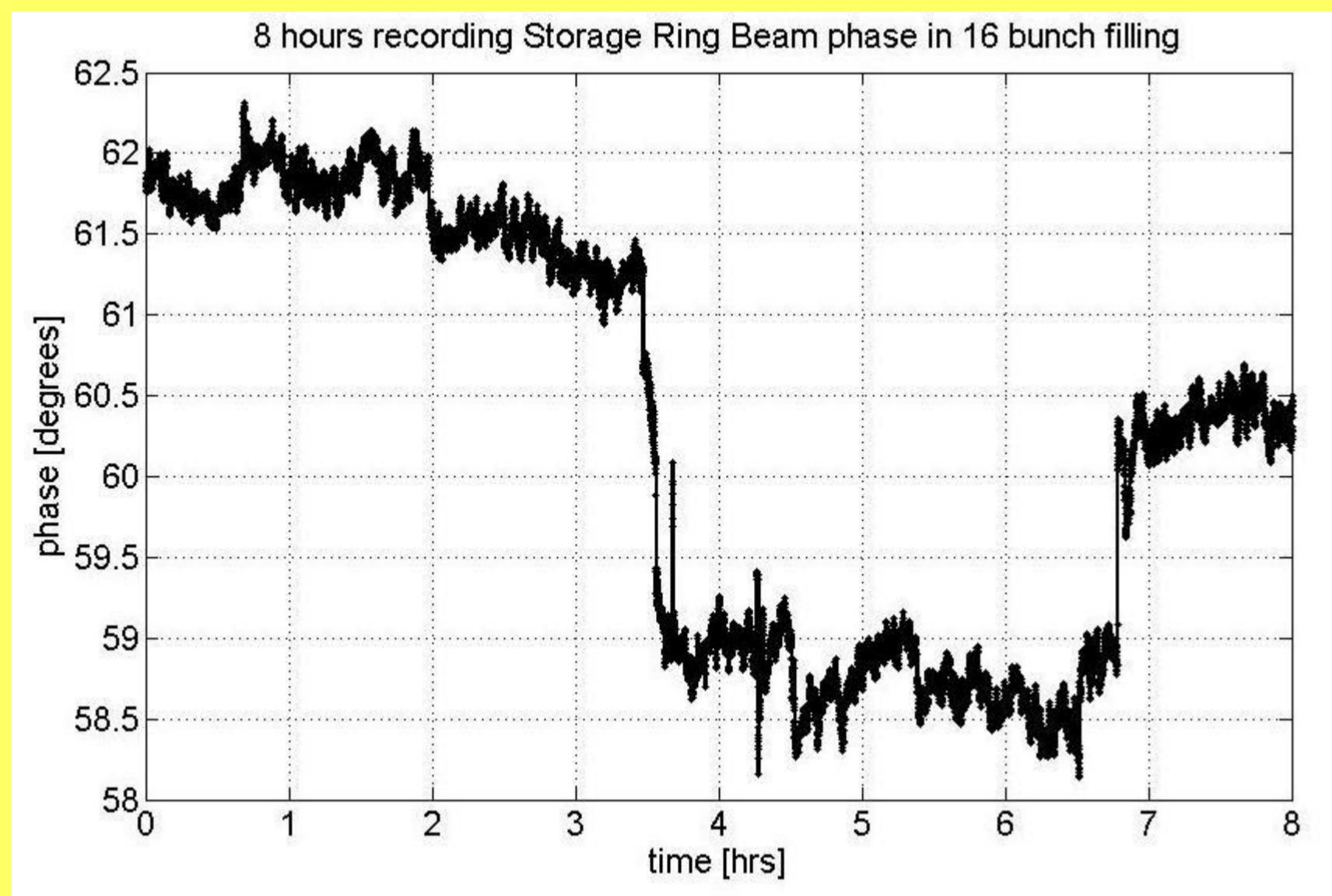2-way Splitter

from RF master
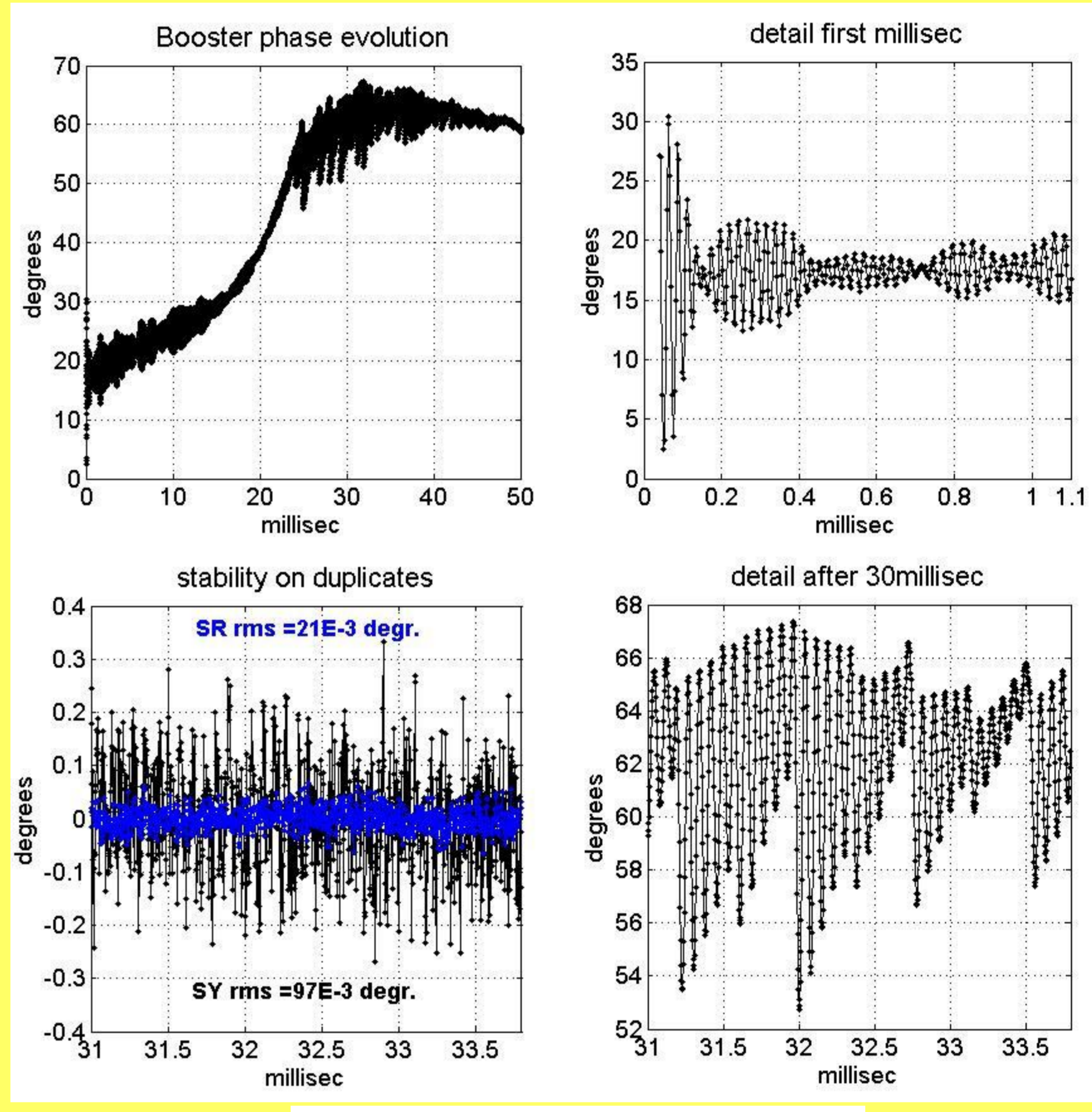
Hardware & interconnections of the
Storage Ring versus RF-master Phase monitor

with a pseudo PLL system inside the Libera
only relative phase measurements are possible
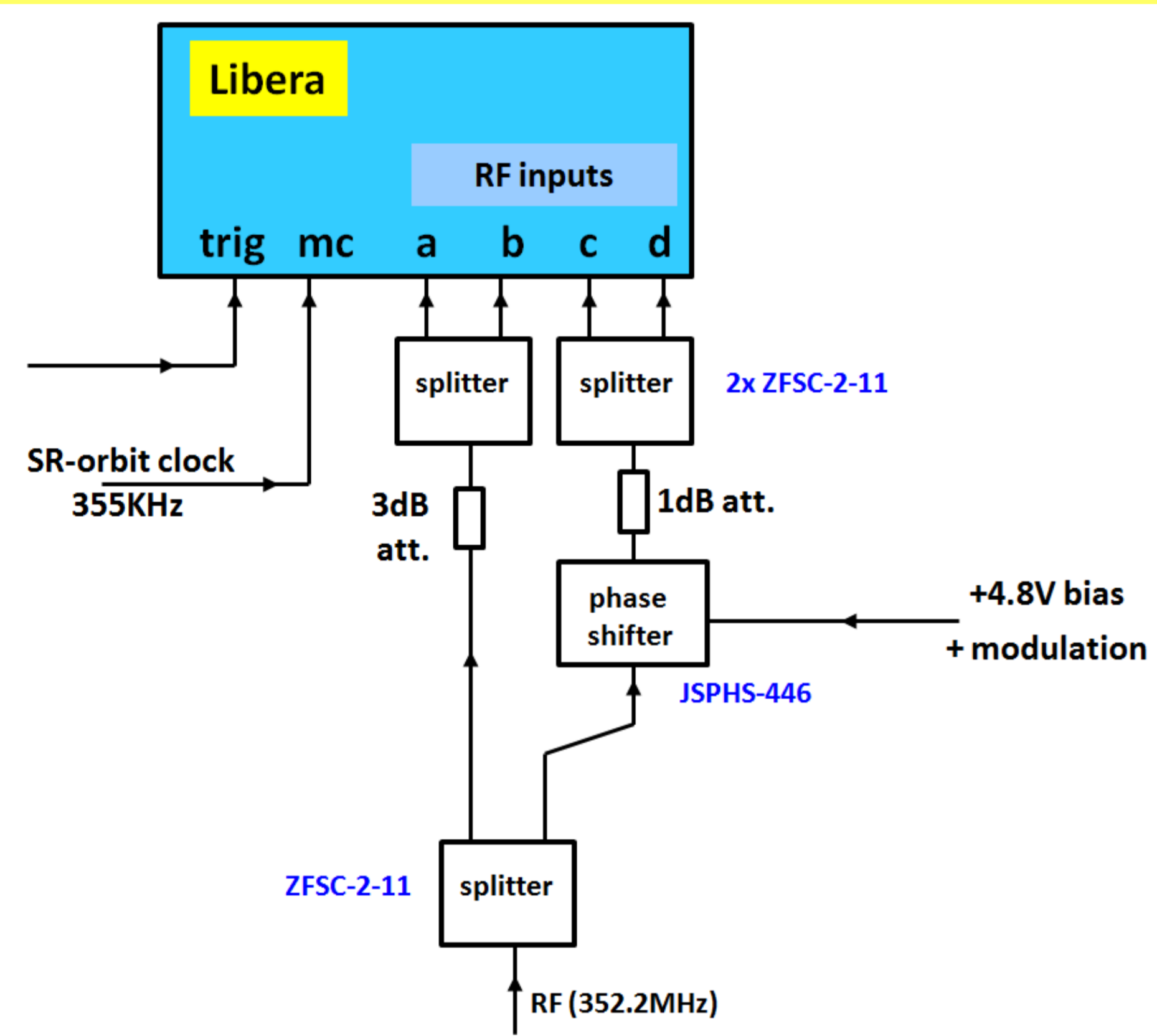between the 4 RF input signals

I & Q values [a.u] of 2 inputs

absolute values [a.u] of 2 inputs
input 1 : mean=3.1E8 , rms=9.4E4
input 2 : mean=2.6E8 , rms=8.4E4

angles [rad] of 2 inputs
angle-1
angle-2

phase [deg] between the 2 inputs
rms = 5.5E-3 degrees

Libera
RF inputs
trig mc a b c d

BPM in SR
a b c d

SR-orbit clock 355KHz

Stripline in SY
left   right
u
d

Hardware & interconnections of the
Booster versus Storage Ring Phase monitor

8 hours recording Storage Ring Beam phase in 16 bunch filling
phase [degrees]
time [hrs]

Libera Brilliance

Booster phase evolution
degrees
millisec

detail first millisec
degrees
millisec

stability on duplicates
SR rms =21E-3 degr.
SY rms =97E-3 degr.
degrees
millisec

detail after 30millisec
degrees
millisec

output from DD buffer i.e. 355KHz, T=2.8uS

Libera
RF inputs
trig mc a b c d

splitter splitter   2x ZFSC-2-11

SR-orbit clock 355KHz

3dB att.   1dB att.

phase shifter   +4.8V bias + modulation

JSPHS-446

ZFSC-2-11   splitter
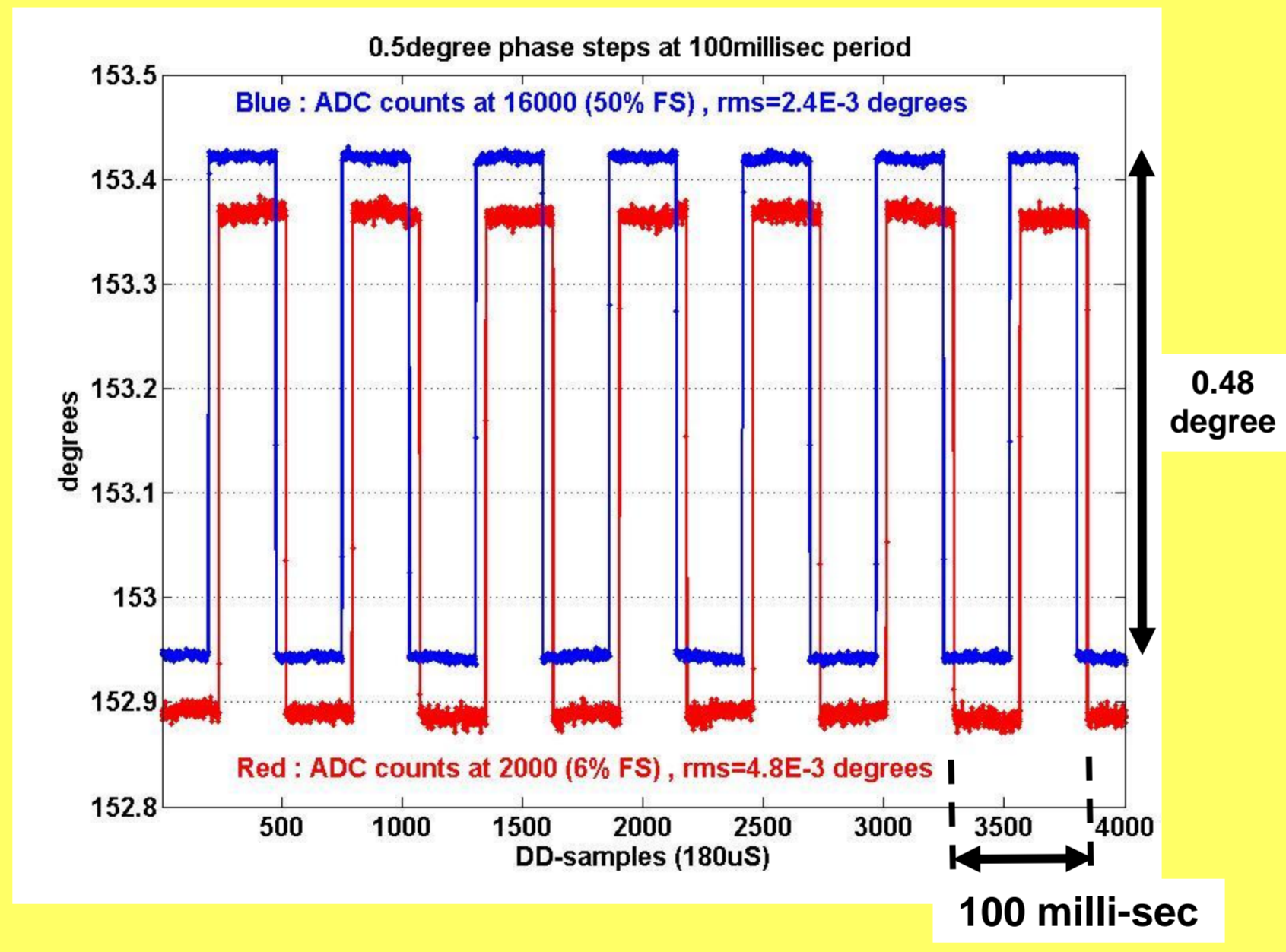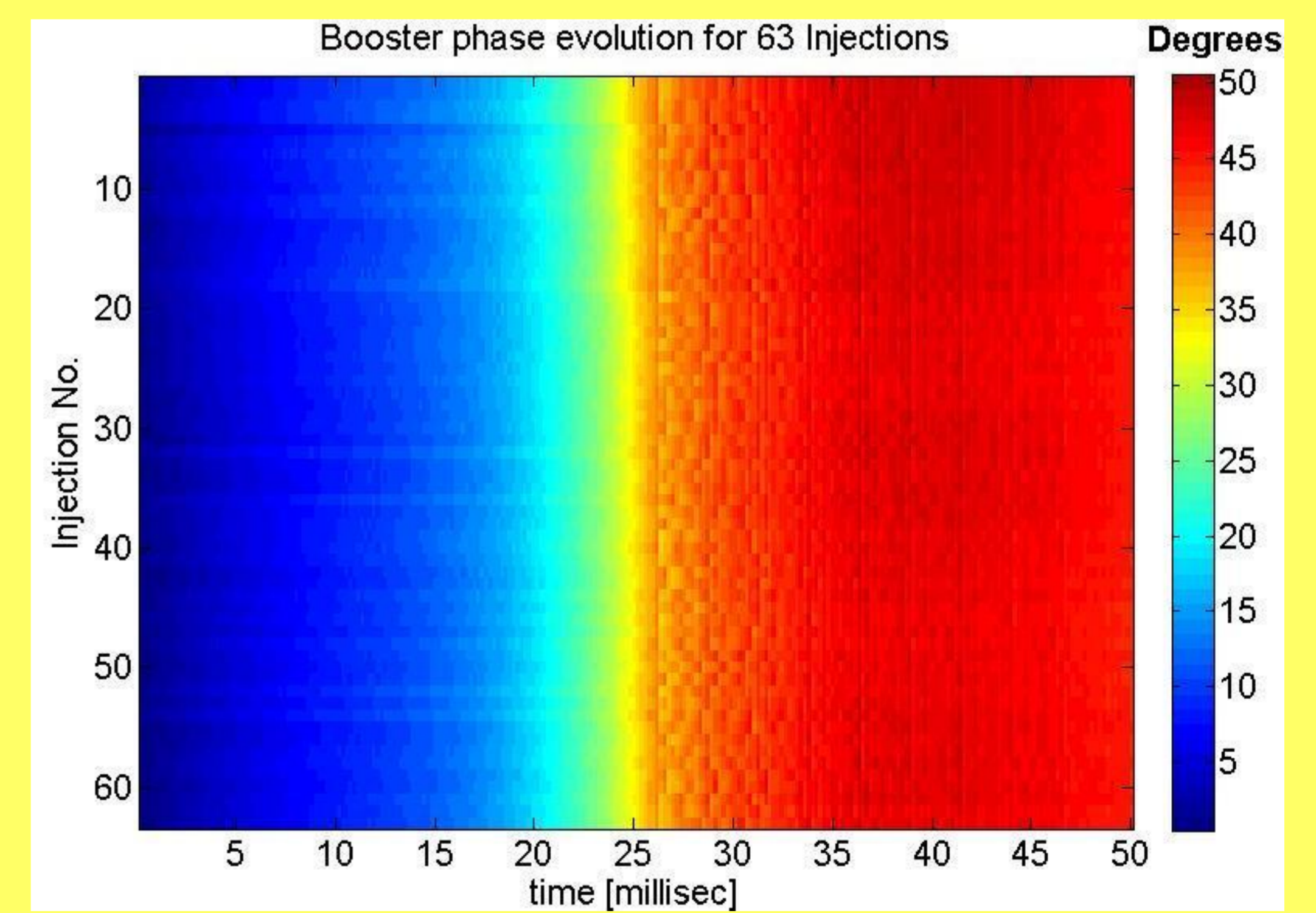
RF (352.2MHz)

Test Set-Up for tests-measurements
with external electronic phase-shifter

results of phase variations
produced by the phase shifter
at 100millisec period
and 100mV amplitude

0.5degree phase steps at 100millisec period
Blue : ADC counts at 16000 (50% FS) , rms=2.4E-3 degrees
0.48 degree
Red : ADC counts at 2000 (6% FS) , rms=4.8E-3 degrees
degrees
DD-samples (180uS)
100 milli-sec

output from DD-64 buffer i.e. 5.5KHz, T=180uS

Booster phase evolution for 63 Injections
Degrees
Injection No.
time [millisec]

output from DD-64 buffer i.e. 5.5KHz, T=180uS

heating 5m RG214 cable from 26 to 38C
phase shift [degrees]
time [sec]
phase shift of approx. 0.1degree
for 1 degree temperature
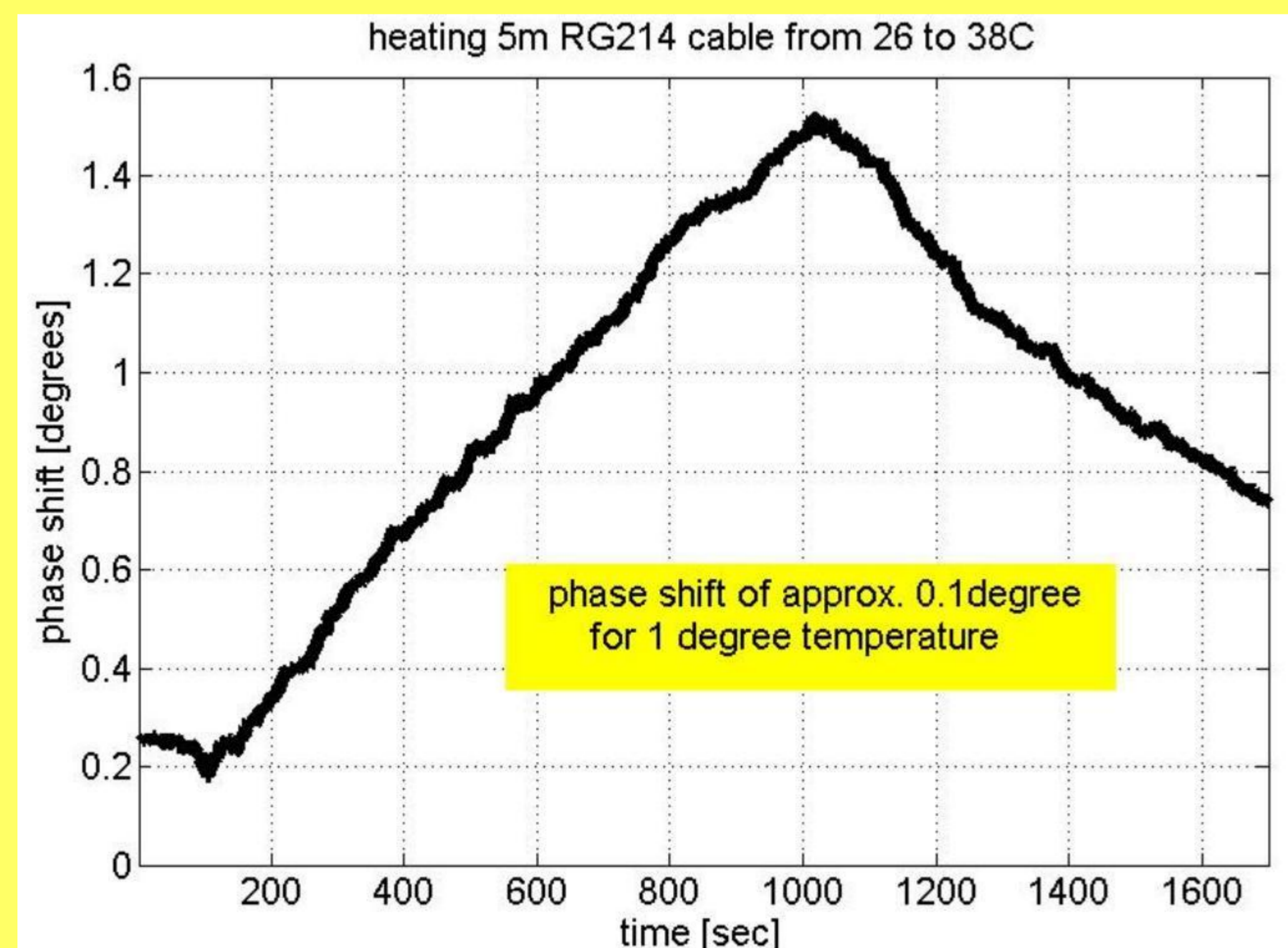
Libera device is read-out via Tango-device-server
and I & Q values then treated by Matlab commands
to generate phase values,

typical Matlab commands used :
complex, angle, unwrap and mod

Booster phase evolution for 2 Injection Shots
Injection No.
time [millisec]