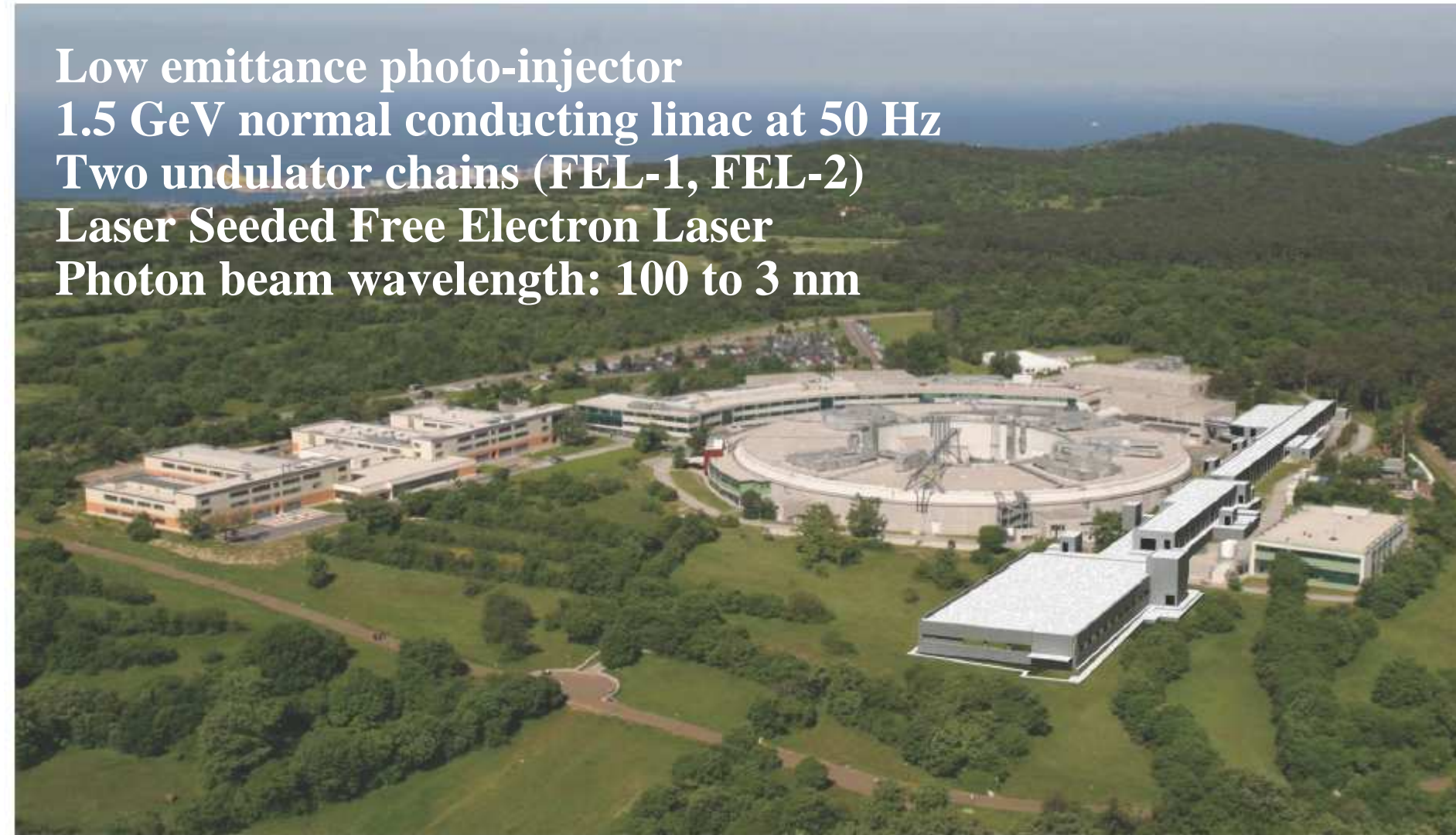


Libera@ELETTRA

Marco Lonza, Giulio Gaio, Stefano Cleva

Sincrotrone Trieste - ELETTRA

Low emittance photo-injector
1.5 GeV normal conducting linac at 50 Hz
Two undulator chains (FEL-1, FEL-2)
Laser Seeded Free Electron Laser
Photon beam wavelength: 100 to 3 nm



STATUS:

started positioning of machine components and
technical racks of the first part of the linac

COMMISSIONING SCHEDULE:

First phase (linac 230 MeV): 18th of August 2009

Second phase (whole linac): June 2010

Third phase (transfer line and spreader): August 2010

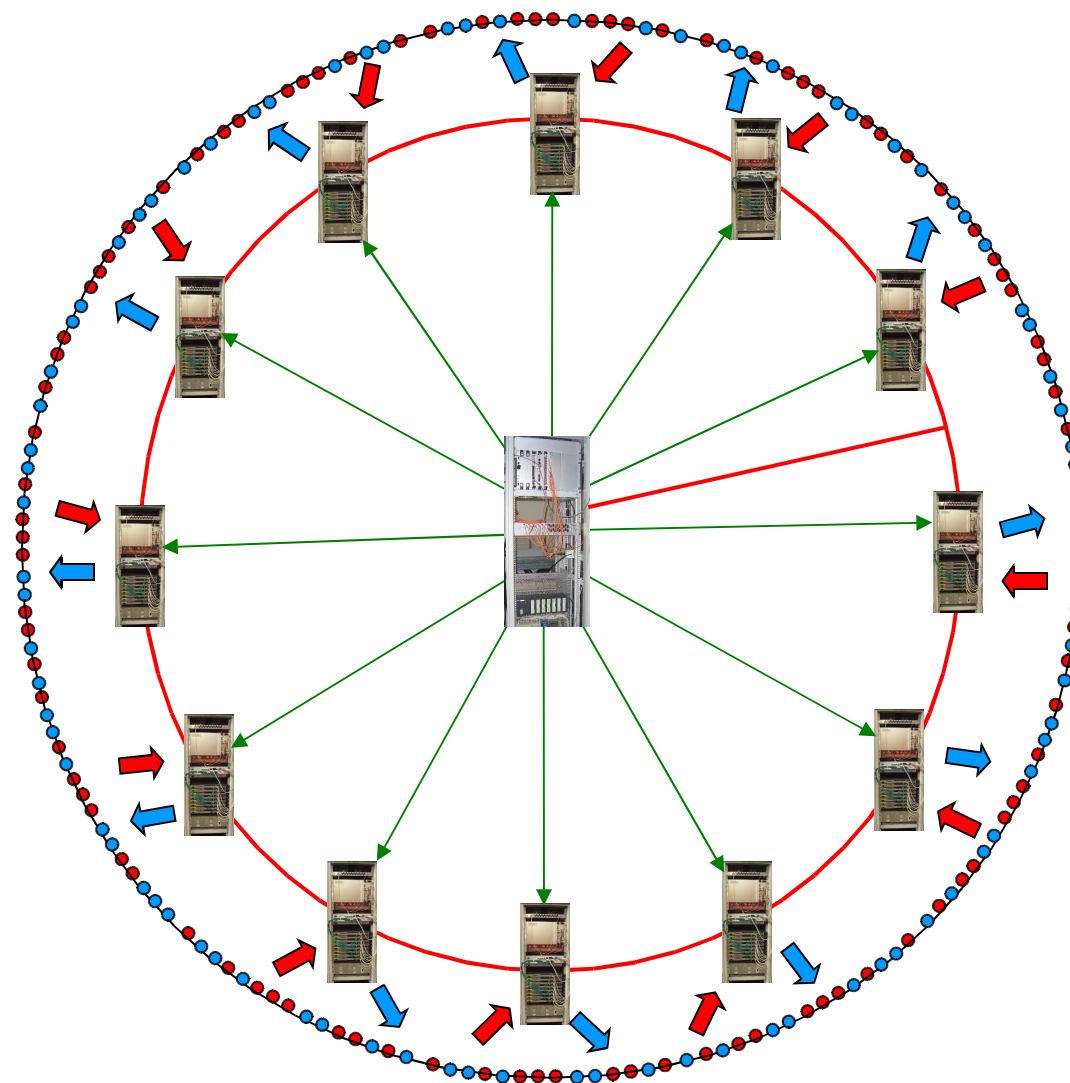
Fourth phase (FEL-1): October 2010

Operations: January 2011

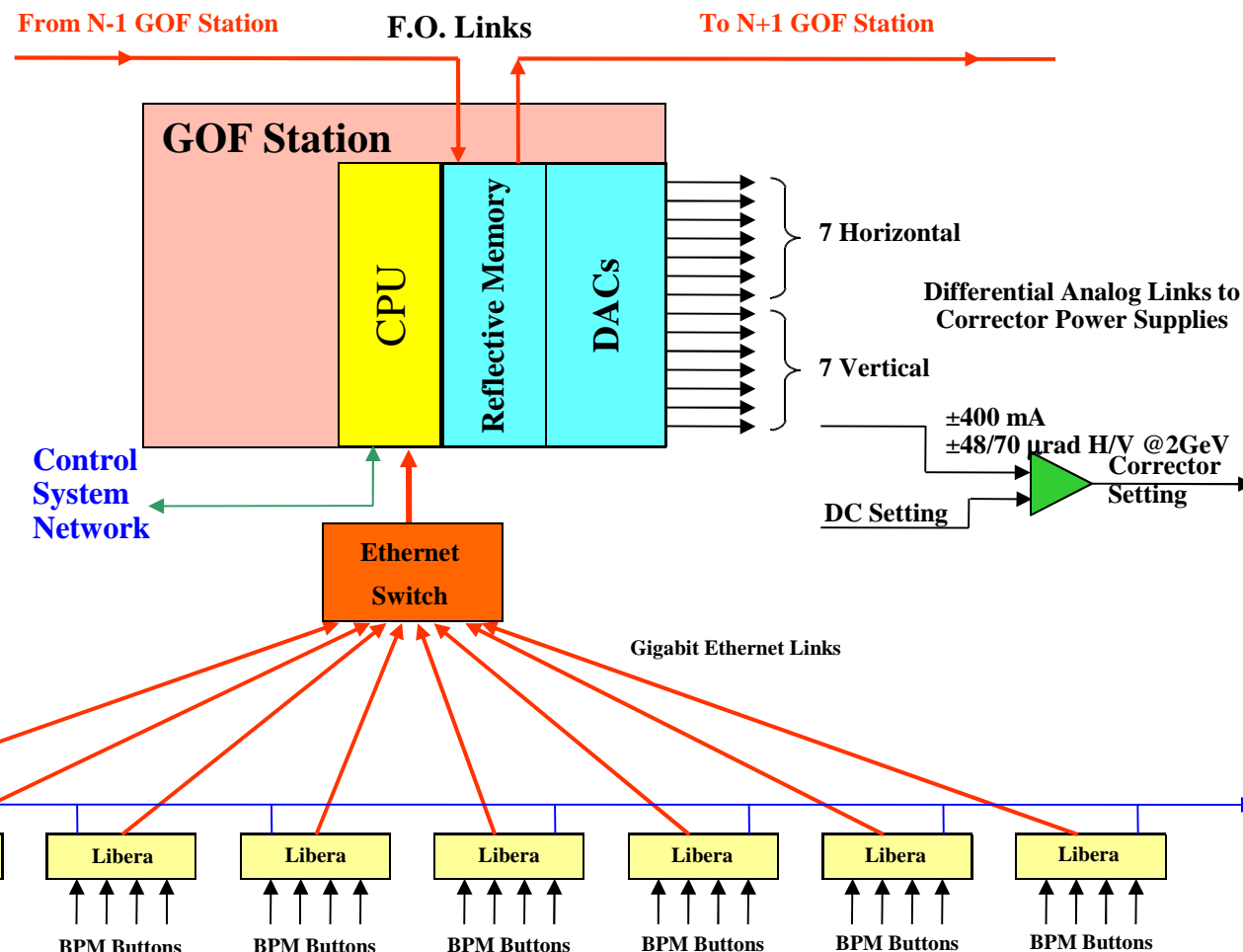
- Single pass machine (trigger required)
- Libera Brilliance devices will be used (~50 units)
- Release 2.03 (work in progress...)
- Embedded tango server
- Custom Gigabit Ethernet (Gbe) for real-time feedback purposes
- Increased charge sensibility (100 pC for FERMI commissioning)

Global Orbit Feedback Architecture

- 96 rhomboidal + 4 low-gap BPMs all equipped with Libera Electron (82 corrector magnets per plane)
- 12 VME stations with Motorola 6100 CPU boards running Linux (Tango) and RTAI (RT extension for feedback processing)
- feedback stations acquire position data at 10 kHz from Libera Electron through Gigabit Ethernet links
- data shared in real-time through Reflective Memory fibre optics
- 10 kSample/s D/A converters generate the analog correction signals
- Master Station connected to the reflective memory for feedback supervision and data acquisition
- Event system: 1 EVG, 12 EVR, Libera Clock Splitters and fibre optics to distribute MC, SC, PM and Trigger signals



Global Orbit Feedback Architecture



Milestones of the feedback project



- ✦ existing RF BPM detectors replaced with *Libera Electron*: March 2006-March 2007
- ✦ installation of the feedback system: February 2007
- ✦ loop closed: March 2007
- ✦ since beginning of September 2007 the feedback is routinely used during users shifts
- ✦ further developments suspended since Spring 2008 (FERMI has higher priority)
- ✦ still work to be done to integrate the feedback with other machine physics applications

- Operation procedure:
 - Full energy injection in the Storage Ring (2 or 2.4 GeV)
 - Local orbit correction after closing the IDs
 - Switch on the Fast Global Feedback
 - Exclude the correction in one section to permit local orbit adjustment if necessary
- correction algorithm: SVD with singular values reduction (21 s.v.)
- path length drift compensation by RF variation (operational but not routinely used)
- weighting of BPMs to privilege the correction at the IDs with respect to global one
- the response matrix can be changed on the fly when the feedback is running (ex. BPM/correctors weights, number of singular values, ...)

BPM Weights



GOF configuration <@pebbles> <2>

BPM CORR

	horizontal								vertical									
	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8		
S1	1	1	1	1	1	1	0.9	1	1	1	1	1	1	1	1	1	set 0	set 1
S2	1	1	1	1	1	1	0.9	1	1	1	1	1	1	1	1	1	set 0	set 1
S3	1	1	0.6	0.6	1	1	0.9	1	1	1	0.6	0.6	1	1	1	1	set 0	set 1
S4	1	1	1	1	1	1	0.9	1	1	1	1	1	1	1	1	1	set 0	set 1
S5	1	1	1	1	1	1	0.9	1	1	1	1	1	1	1	1	1	set 0	set 1
S6	1	1	0.6	1	1	1	0.9	1	1	1	0.2	1	1	1	1	1	set 0	set 1
S7	1	1	0.6	0.6	1	0	0.9	1	1	1	0.5	0.5	1	0	1	1	set 0	set 1
S8	1	1	1	1	1	1	0.9	1	1	1	1	1	1	1	1	1	set 0	set 1
S9	1	1	1	1	1	1	0	1	1	1	1	1	1	1	0	1	set 0	set 1
S10	1	1	1	1	1	1	0	1	1	1	1	1	1	1	0	1	set 0	set 1
S11	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	set 0	set 1
S12	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	set 0	set 1

ON Standby OFF **DISABLE**

+ 0 0 0 . 0 set set 0 set 1

Correctors weights

GOF configuration <@pebbles> <2>

BPM CORR

	horizontal							vertical						
	1	2	3	4	5	6	7	1	2	3	4	5	6	7
S1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
S2	1	1	1	1	1	1	1	1	1	1	1	1	1	1
S3	1	1	1	1	1	1	1	1	1	1	1	1	1	1
S4	1	1	1	1	1	1	1	1	1	1	1	1	1	1
S5	1	1	1	1	1	1	1	1	1	1	1	1	1	1
S6	1	1	1	1	1	1	1	1	1	1	1	1	1	1
S7	1	1	1	1	1	1	1	1	1	1	1	1	1	1
S8	1	1	1	1	1	1	1	1	1	1	1	1	1	1
S9	1	1	1	1	1	1	1	1	1	1	1	1	1	1
S10	1	1	1	1	1	1	1	1	1	1	1	1	1	1
S11	1	1	1	1	1	1	1	1	1	1	1	1	1	1
S12	1	1			1	1	1	1	1			1	1	1

set 0 set 1

set 0 set 1

set 0 set 1

set 0 set 1

set 0 set 1

set 0 set 1

set 0 set 1

set 0 set 1

set 0 set 1

set 0 set 1

set 0 set 1

set 0 set 1

ON Standby OFF DISABLE

+ 0 0 0 . 0 set set 0 set 1

GOF <@pebbles>

Global Feedback Status

OFF

On

Standby Off

Max. Correctors' Strength [%]

H: V:

BPMs rms (Average)

H: $\sqrt{1.760}$ [um] V: $\sqrt{0.839}$ [um]

Difference Orbit rms

H: $\sqrt{1497.798}$ [um] V: $\sqrt{613.687}$ [um]

View Expert Panel

View BPM and Correctors Weights

View Orbit and Correctors

Operator Panel

GofControl <@pebbles>

Standard Expert Loops

Server Status

ON Init

Correctors' Link

Check

Enable Disable

Clear DACs

AGC

Some Disabled Enable Disable

Acquisition

Start Stop

Synch Liberas

GofControl <@pebbles>

Standard Expert Loops

Feedback Status

Feedback On

Feedback On Feedback Off

Take Reference Orbit

Freeze Unfreeze

Global feedback ON
Dispersion loop running
Recovery loop running
Drift loop stopped

GofControl <@pebbles>

Standard Expert Loops

Dispersion Loop

On Enable Disable

499654000.0 Starting RF

-0.0 Required Diff.

0.0 Applied Diff.

499654000.0 Current RF

Drift Loop

Off Enable Disable

Recovery Loop

On Enable Disable

Expert Panels

GofMonitor <@pebbles>

Orbit Correctors

Mean: 1.6 Rms: 361 Peak2Peak: 2944 Min: -1484 Max: 1460

S1 S2 S3 S4 S5 S6 S7 S8 S9 S10 S11 S12

H [Counts]

GofMonitor <@pebbles>

Orbit Correctors

Mean: 0.1 [um] Rms: 1.6 [um] Peak2Peak: 10.0 [um] Min: -5.3 [um] Max: 4.7 [um]

S1 S2 S3 S4 S5 S6 S7 S8 S9 S10 S11 S12

H [um]

GofMonitor <@pebbles>

Orbit Correctors

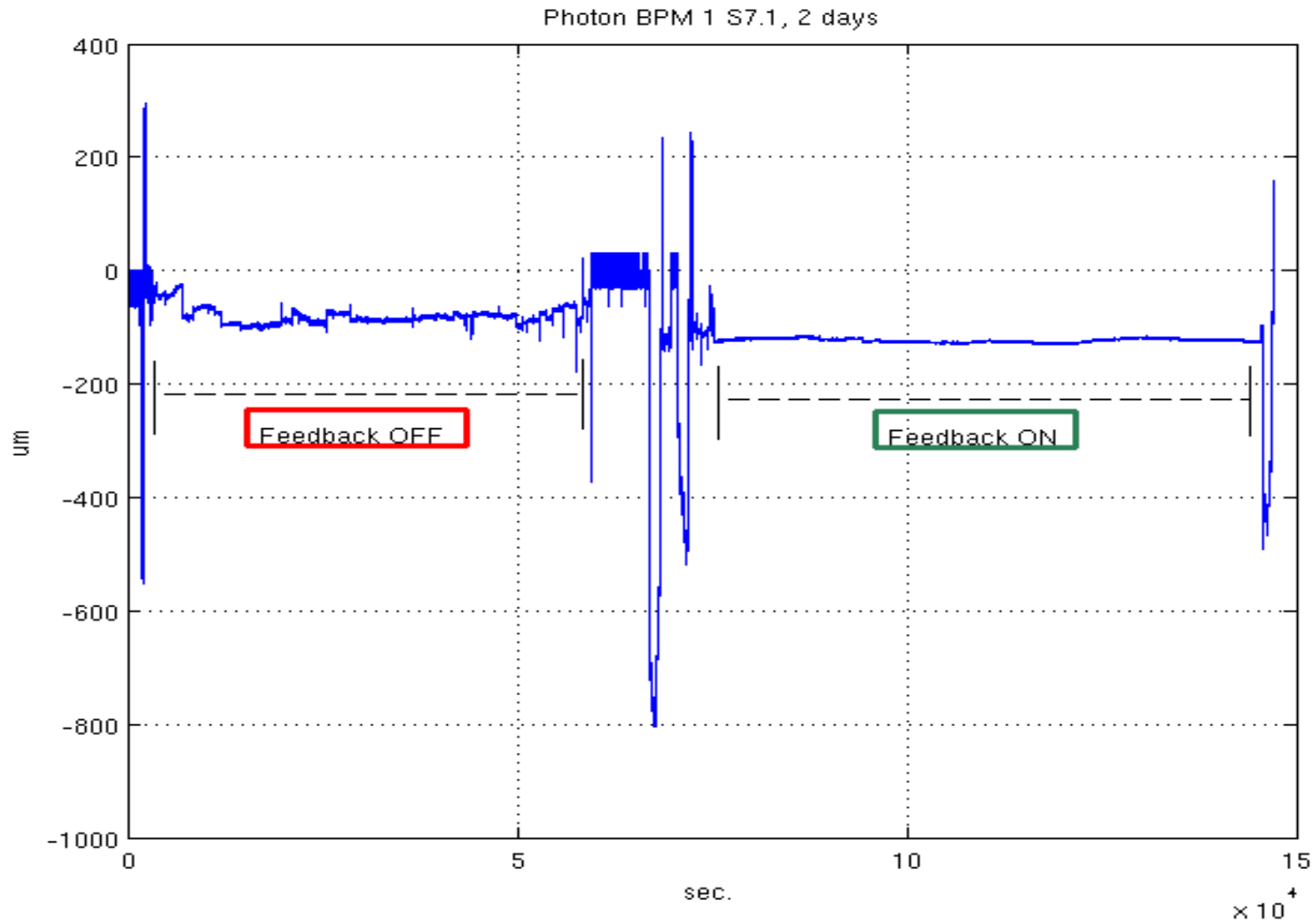
Mean: -0.1 [um] Rms: 1.9 [um] Peak2Peak: 9.9 [um] Min: -5.8 [um] Max: 4.2 [um]

S1 S2 S3 S4 S5 S6 S7 S8 S9 S10 S11 S12

V [um]

Show Relative to Golden Orbit Take Reference Orbit Clear Reference Orbit

Long term photon beam stability



- Embedded Tango Device Server (by Nicolas Leclercq - SOLEIL) running in the SBC on top of the Generic Server
- the Tango server is a modified version of the one developed for the 1.40 release
- need for a closer coordination and collaboration between Tango/Libera users with respect to the development and maintenance of the Libera Tango Server
- Tango Device "inside" or "outside" Libera? What about Soleil, ESRF, ALBA, ...?
The behavior of the Tango Server seems different! Tango Server needs debugging directly in the SBC

- Electron vs Brilliance (spare parts)
- Reliability concerns
- Libera diagnostic in case of fault: need to define a common procedure for Libera testing
- JTAG and flash images (e.g. flash corruption or upgrade crash)
- Improve upgrade procedure (single step and not incremental)
- Development environment (common SW platform, Virtual Machine,...)
- CVS: is Tango development environment downloadable?
- Bugzilla