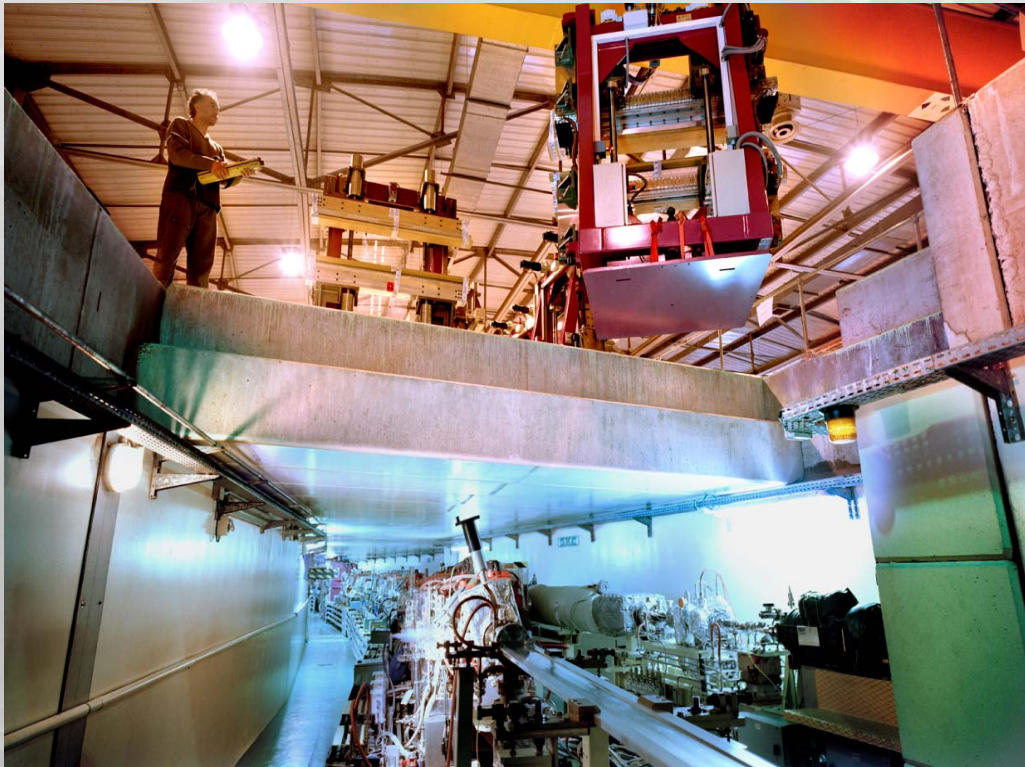




Advanced Photon Source




ESRF: Accelerator Operation and Stability

Jean-Luc Revol

On behalf of the Accelerator and
Source Division

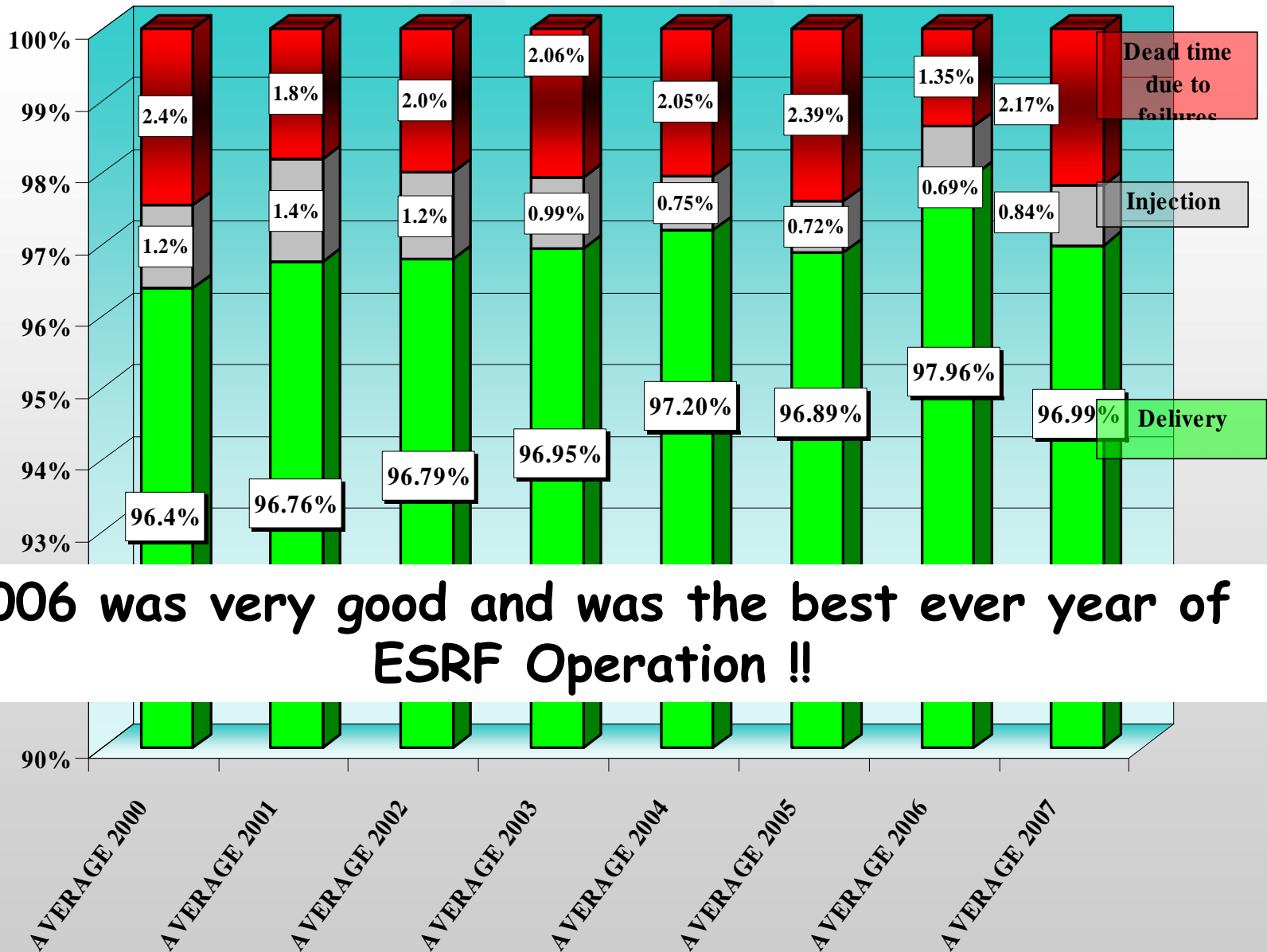
**ESRF, SPring-8, APS
Three-Way Meeting (3WM08)
Argonne National Laboratory
March 17-19, 2008**

- 
- A decorative background pattern consisting of numerous light blue circles of varying sizes, arranged in a roughly circular or fan-like shape, centered in the upper half of the slide.
- 1. Statistics**
 - 2. Main difficulties in 2007**
 - 3. MDT developments linked to operation**
 - 4. Filling pattern evolution**
 - 5. Stability**
 - 6. Control system**
 - 7. Electronic Logbook**

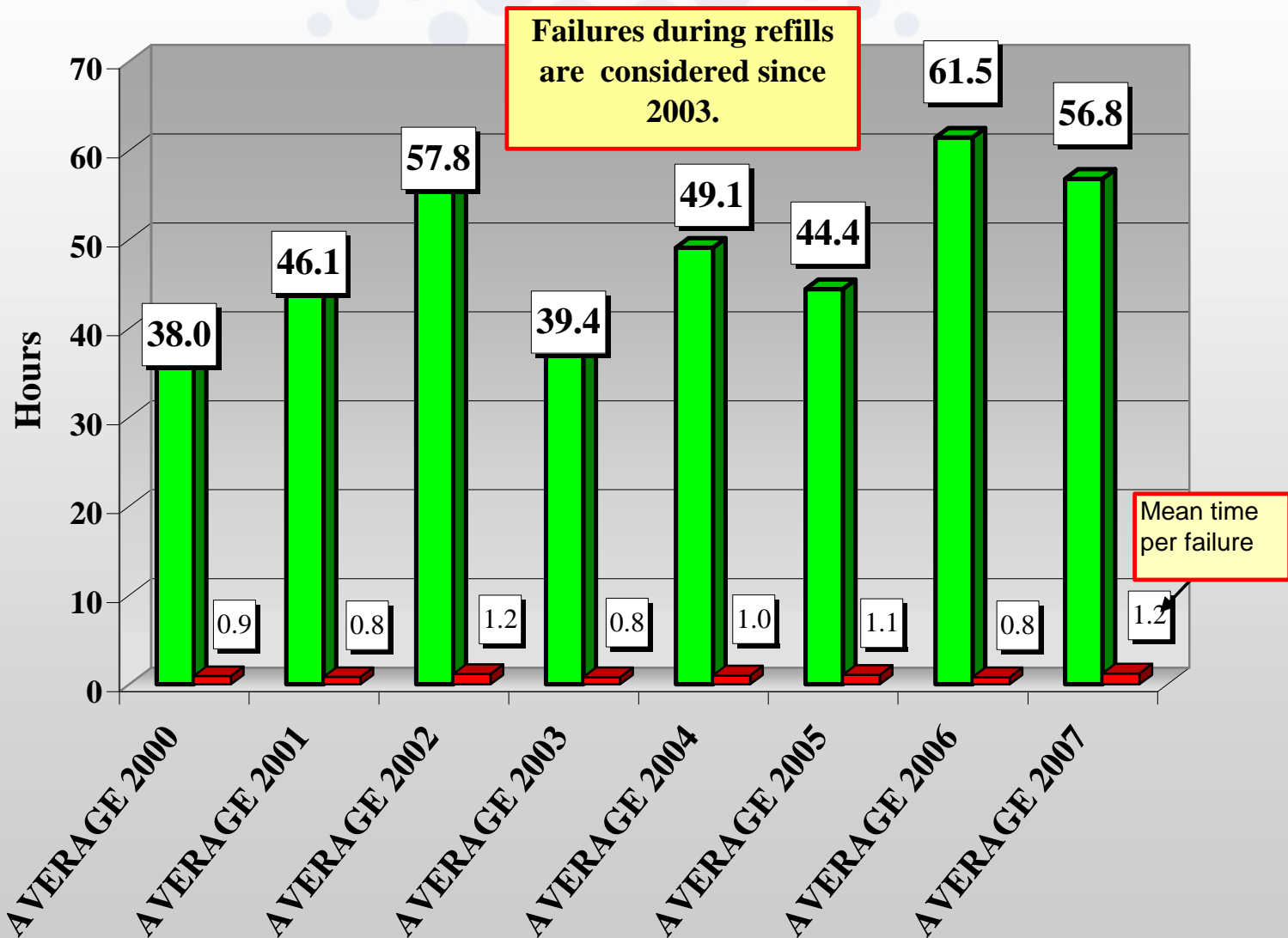
	2005	2006	2007
Xray source availability (%)	97.6	98.7	97.8
Mean time between failures (hrs)	44.4	61.5	56.8
Mean duration of a failure (hrs)	1.1	0.8	1.24

Number of failures	123	85	96
<i>Time lost in hours</i>	131	71	114
<i>Accelerator downtime</i>	2.4%	1.3%	2.1%

Lowest figure achieved since the start of the ESRF



Mean Time Between Failures over the years



The main reasons for downtime in 2007:

Events influencing **AVAILABILITY**
11 failures > 2 hours

- Stripline Cell 4 (July 2007)
 (27 USM hours)
- Default on 24 V PS on RF HIS
 inducing wrong interlocks (5 hrs)

Events influencing **MTBF**
97 failures < 1 hour

- SRRF : 21
- HQPS / Mains: 13
- Human Mistakes : 10 !

Events influencing both
MTBF and AVAILABILITY

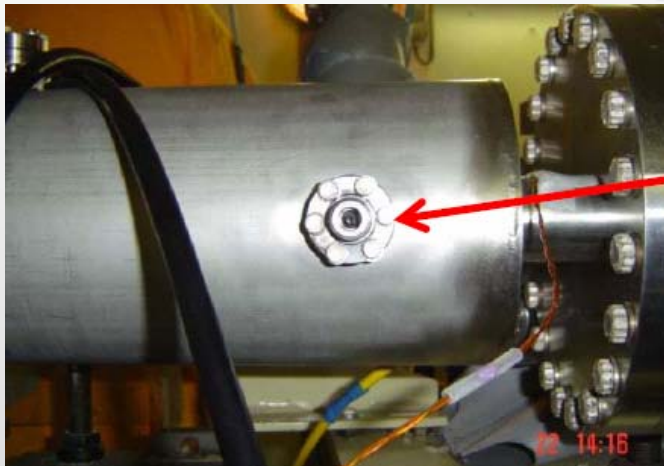
- Absence of HQPS
 → Drops on electrical mains: 22.5
 hours lost for 22 failures !!!

Significant Events influencing **or not**
Beam Quality Delivery

- Leak on SRRF cavity 5
- Defective RF finger cavity 3
 → reduced intensity in 16 bunch

Failure of the horizontal stripline

End of run 3 in July

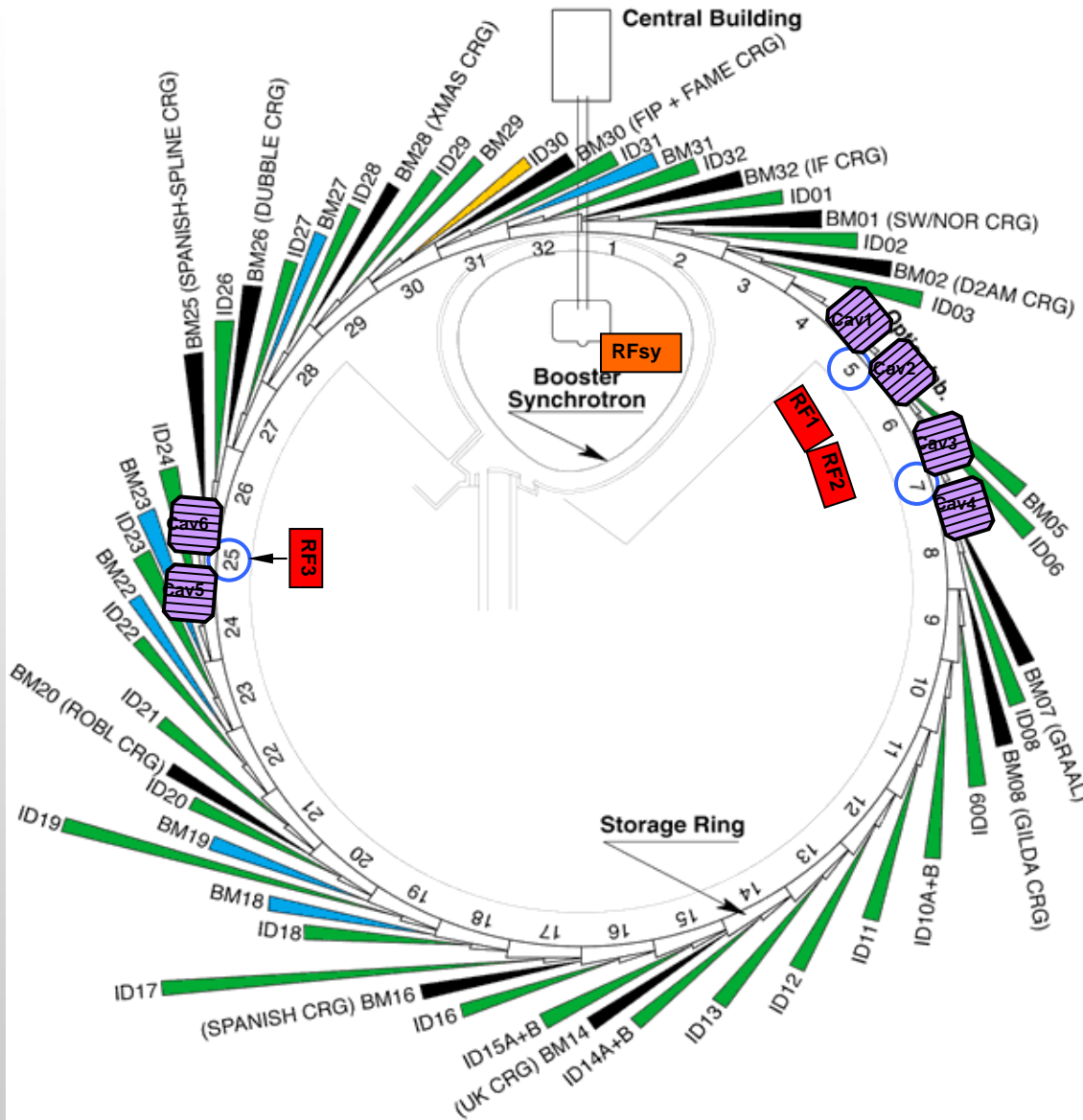


Fire alarm and broken feed through on the horizontal stripline in cell4

Repaired but end of the run cancelled: a total of 75 hours lost but 27 hours "only" in USM since 2 USM days were given back to Users

Due to high peak power induced in 4 x 10 mA and 16 bunch operation

***New design installed in October shutdown with low pass filter in the gap
→ reduced voltage***



8 RF copper cavities

2 cavities in booster

6 cavities in the storage ring

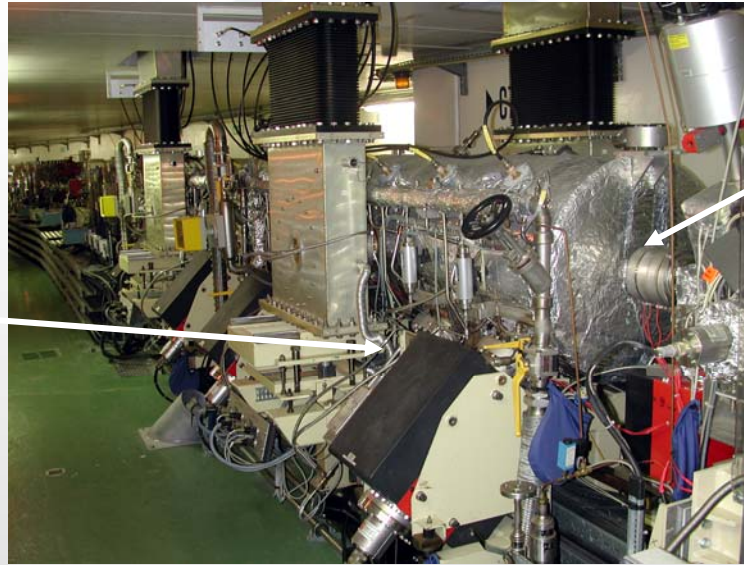
3 straight sections (5metres)
occupied in the storage ring

→ No major difficulties since
1992

Restart of June 2007

**Leak on cavity 5
tuner port 2**

Induced by a problem of welding on the port of the piston tuner during manufacturing in 1997
 → problem appeared 10 years later.

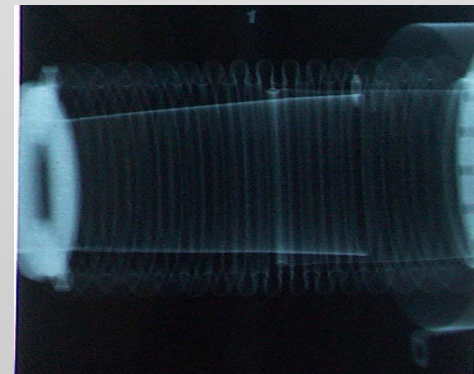


September 2007

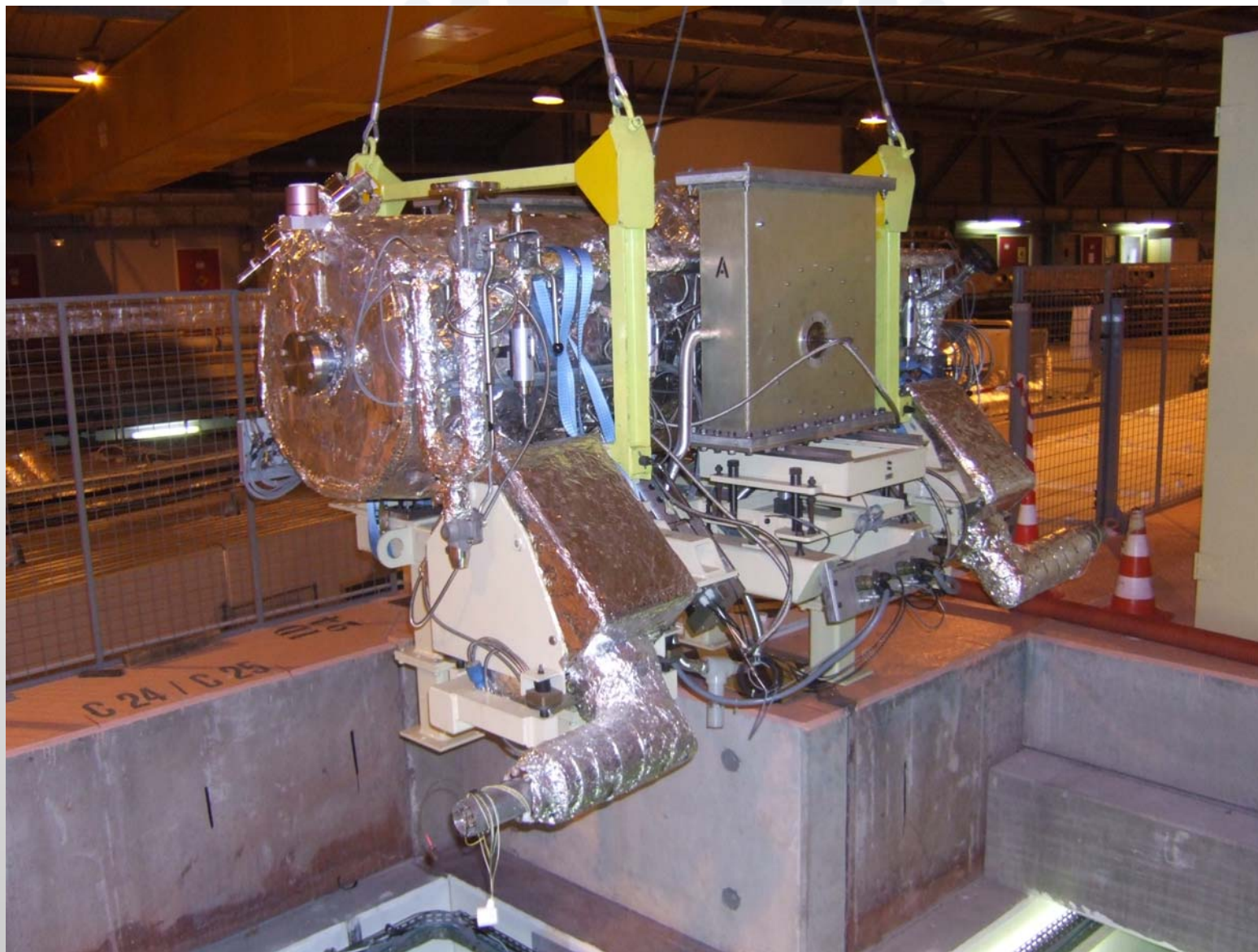
**Strong outgassing
in the bellow
adjacent to cavity 3
from a defective RF
finger in 16 Bunch**

Current limited to 70 mA

**Operation without cavity 5
for 6 months**

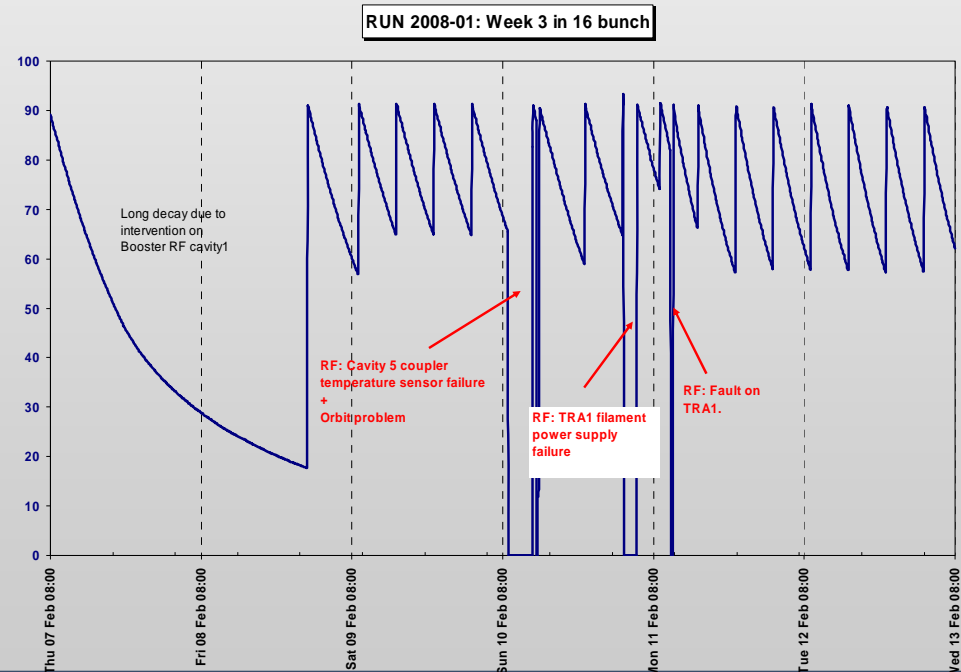


- **DECISION:** no further risk for operation → stop powering Cavity 5
- **11th June:** start of the run without TRA3 / Cav 5&6
 - Fall back RF working point for 200 mA:
 - HOM detuning not perfectly reliable ⇒ 2/3 filling for Landau damping
- **19th June MDT:** Implement operation with 5 cavities
 - Disconnect leaky cavity 5, tuners on parking position
 - Setup operation at 200 mA including HOM detuning
 - Successfully applied at 200 mA until Christmas shut down
- Existing **spare Cavity prepared** to replace Cavity 5 during Christmas shut down
 - Baked * RF conditioned on RF power teststand using TRA2
- **Winter shutdown:**
 - Replace RF fingers upstream and downstream pair cavity3&4
Cavities carefully vented, baked out
 - Replace cavity5 and baked out
 - Winter shutdown shortened by 3 days for RF conditioning and beam restart
- **January restart:**
 - No major difficulties to restart beam
 - But slow vacuum conditioning
 - After restart, still strong vacuum out gassing depending of the working points
→ need more RF conditioning



Fall 2007, air leak appears on a small pick up feed through used for measurement

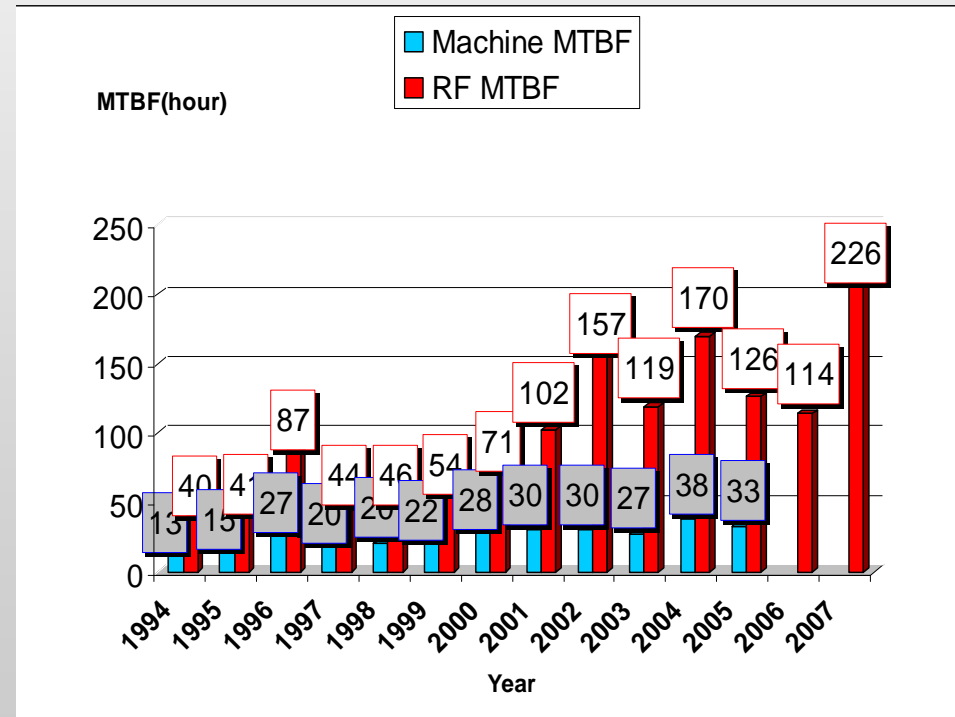
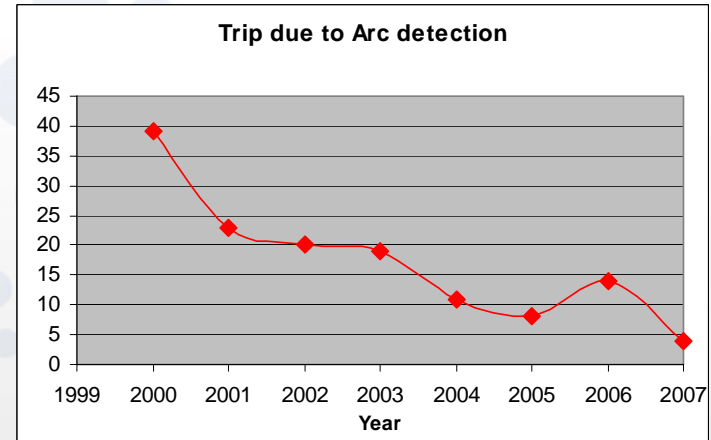
- Cavity 1&2 put to atmospheric pressure during winter shutdown
 - ➔ *Feed through replaced and cavity reconditioned*
- Then a leak took place in the RF coupler
 - ➔ *Coupler changed at the end of the shutdown and reconditioned*
- 2 weeks after the restart again a leak on the exchanged coupler
 - ➔ *Coupler changed in emergency during user service and reconditioned*



Record RF-MTBF in 2007:

Only 24 RF trips, despite severe cavity vacuum problems

- **Low Level RF: 0 trip** → benefit from preventive maintenance
- **Klystrons: 4 trips** → instabilities & Vacuum interlocks
- **Klystron auxiliaries: 2 trips**
- **HVPS: 1 trip** → crowbar due to thunderstorm
- **Arcs: only 4 trips**
→ noise floor
- **Control: 2 trips** → 1 unexplained driver disable by PLC, 1 circ. Load interlock wrongly cabled on cavity interlock chain
- **Cavity 5: 1 break down**
- **Other cavities: 10 trips** → breakdowns (Cav 1 & 3), overvoltage (Cav 4)



File Edit View Go Bookmarks Tools Help

http://www.meteorage.fr/cgi-bin/catsweb/obsweb/obsweb.pl?sid=38cf5d7caf3dde

ESRF Trouble Ticket JLOGBOOK Operator's main WEB ...

Observation WEB Meteo France - Carte de prévisions ...

déconnexion

Date de l'image: 08/07/07 20:45

Visualisation de l'activité orageuse

- 08/07 19:11
- 08/07 19:41
- 08/07 20:11
- 08/07 20:41
- 08/07 21:11

Nombre d'impacts

580

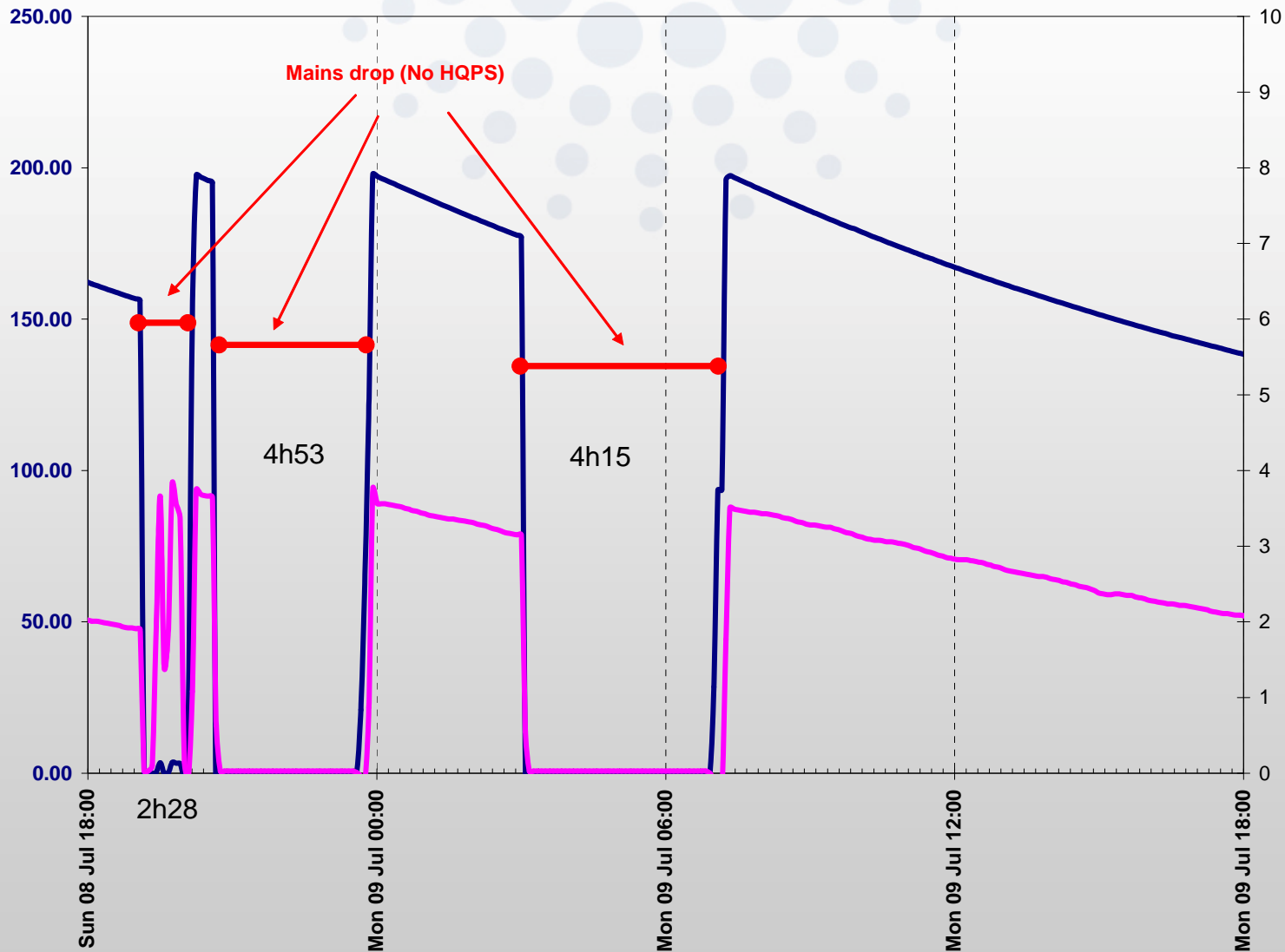
Heure : 20:45:23
 Lat. 45.3 deg.
 Lon. 5.8 deg.
 Amp. -10.1 kA

Done

**Sunday 08/07/2007 evening
500 impacts in 2 hours**



RUN 2007- 03: Week 4 in hybrid 24*8+1 filling mode



- The **HQPS1 system** run with difficulties its last months of operation.
 - ➔ The stop took place in September 2007.
- *The arrangement of an accumulator with a diesel engine through an electro-magnetic clutch is the origin of our problems. Suppressing the clutches and the diesel engines is the way to resolve this situation safely*
- ➔ 8 units over 10 were sold
 - ➔ Unit 2 kept to avoid any lack of evidence in the damages for the legal case.
 - ➔ Unit 1 refurbished to protect ESRF accelerators during long cuts linked to the HQPS2 system

Origin of the problem:

Magnetic field leakage at the clutch location inducing eddy currents in the crankshaft and in bearings



HQPS1 was divided into 10 units of ~ 1 MVA

The Beam Losses due to the absence of HQPS + Mains drop

Jan 2007	Feb 2007	Mar 2007	Apr 2007	May 2007	Jun 2007	Jul 2007	Aug 2007	Sep 2007	Oct 2007	Nov 2007	Dec 2007	Jan 2008															
Mon 01	s s s	Thu 01	...	Thu 01	...	Sun 01	M M M	Tue 01	M M M	Fri 01	s s s	Sun 01	...	Wed 01	s s s	Sat 01	...	Mon 01	...	Thu 01	...	Sat 01	...	Tue 01	s s s		
Tue 02	s s s	Fri 02	...	Fri 02	...	Mon 02	M M M	Wed 02	...	Wed 02	...	Mon 02	...	Thu 02	s s s	Sun 02	...	Tue 02	M M M	Fri 02	...	Sun 02	...	Sun 02	...	Wed 02	s s s
Wed 03	s s s	Sat 03	...	Sat 03	...	Tue 03	...	Tue 03	...	Sun 03	s s s	Tue 03	M M M	Fri 03	s s s	Mon 03	...	Wed 03	...	Sat 03	...	Mon 03	...	Thu 03	s s s	Thu 03	s s s
Thu 04	s s s	Sun 04	...	Sun 04	...	Wed 04	...	Wed 04	...	Mon 04	s s s	Wed 04	...	Sat 04	s s s	Tue 04	...	Thu 04	...	Sun 04	...	Tue 04	...	Fri 04	s s s	Fri 04	s s s
Fri 05	s s s	Mon 05	...	Mon 05	...	Thu 05	...	Thu 05	...	Tue 05	s s s	Thu 05	...	Sun 05	s s s	Wed 05	M M M	Fri 05	...	Mon 05	...	Wed 05	...	Sat 05	s s s	Sat 05	s s s
Sat 06	s s s	Tue 06	M M M	Tue 06	M M M	Fri 06	...	Sun 06	...	Wed 06	s s s	Fri 06	...	Mon 06	s s s	Thu 06	...	Sat 06	...	Tue 06	M M M	Thu 06	...	Sun 06	s s s	Sun 06	s s s
Sun 07	s s s	Wed 07	M M M	Wed 07	...	Sat 07	...	Mon 07	...	Thu 07	...	Sat 07	...	Tue 07	s s s	Fri 07	...	Sun 07	...	Wed 07	...	Fri 07	...	Mon 07	s s s	Mon 07	s s s
Mon 08	s s s	Thu 08	...	Thu 08	...	Sun 08	M M M	Mon 08	start-	Sun 08	...	Wed 08	...	Tue 08	s s s	Sat 08	...	Mon 08	...	Thu 08	...	Sat 08	...	Tue 08	s s s	Tue 08	s s s
Tue 09	s s s	Fri 09	...	Fri 09	...	Mon 09	...	Wed 09	...	Sat 09	M M M	Mon 09	...	Thu 09	s s s	Sun 09	...	Mon 09	M M M	Fri 09	...	Sun 09	...	Wed 09	s s s	Wed 09	s s s
Wed 10	s s s	Sat 10	...	Sat 10	M M M	Thu 10	...	Sun 10	M M M	Tue 10	M M M	Fri 10	...	Mon 10	...	Wed 10	...	Sat 10	...	Mon 10	...	Thu 10	...	Tue 10	s s s	Thu 10	s s s
Thu 11	s s s	Sun 11	...	Sun 11	...	Wed 11	...	Mon 11	M M M	Wed 11	...	Sat 11	s s s	Tue 11	...	Thu 11	...	Sun 11	...	Tue 11	M M M	Fri 11	...	Fri 11	s s s	Fri 11	s s s
Fri 12	s s s	Mon 12	...	Mon 12	...	Thu 12	...	Sat 12	...	Tue 12	...	Thu 12	...	Sun 12	s s s	Wed 12	...	Fri 12	...	Mon 12	...	Wed 12	...	Sat 12	s s s	Sat 12	s s s
Sat 13	s s s	Tue 13	M M M	Tue 13	M M M	Fri 13	...	Sun 13	...	Wed 13	...	Fri 13	...	Mon 13	s s s	Thu 13	...	Sat 13	...	Tue 13	M M M	Thu 13	...	Sun 13	s s s	Sun 13	s s s
Sun 14	s s s	Wed 14	...	Wed 14	...	Sat 14	...	Mon 14	...	Thu 14	...	Sat 14	...	Tue 14	s s s	Fri 14	...	Sun 14	...	Wed 14	...	Fri 14	...	Mon 14	s s s	Mon 14	s s s
Mon 15	s s s	Thu 15	...	Thu 15	...	Sun 15	...	Tue 15	M M M	Fri 15	...	Sun 15	...	Wed 15	s s s	Sat 15	...	Mon 15	...	Thu 15	...	Sat 15	...	Tue 15	s s s	Tue 15	s s s
Tue 16	s s s	Fri 16	...	Fri 16	...	Mon 16	...	Wed 16	...	Sat 16	...	Mon 16	...	Thu 16	s s s	Sun 16	...	Tue 16	...	Fri 16	...	Sun 16	...	Wed 16	s s s	Wed 16	s s s
Wed 17	s s s	Sat 17	...	Sat 17	...	Tue 17	M M M	Thu 17	...	Sun 17	...	Tue 17	M M M	Fri 17	start-	Mon 17	...	Wed 17	s s s	Sat 17	...	Mon 17	s s s	Thu 17	s s s	Thu 17	s s s
Thu 18	s s s	Sun 18	...	Sun 18	...	Wed 18	...	Mon 18	...	Wed 18	...	Sat 18	M M M	Tue 18	...	Tue 18	M M M	Thu 18	s s s	Sun 18	...	Tue 18	s s s	Fri 18	M M M	Fri 18	M M M
Fri 19	start-up	Mon 19	...	Mon 19	...	Thu 19	...	Sat 19	...	Tue 19	M M M	Thu 19	...	Sun 19	M M M	Wed 19	...	Fri 19	s s s	Mon 19	...	Wed 19	s s s	Sat 19	M M M	Sat 19	M M M
Sat 20	M M M	Tue 20	M M M	Tue 20	...	Fri 20	...	Wed 20	...	Tue 20	...	Mon 20	M M M	Thu 20	...	Mon 20	M M M	Wed 20	s s s	Sat 20	s s s	Tue 20	M M M	Thu 20	s s s	Sun 20	M M M
Sun 21	M M M	Wed 21	...	Wed 21	s s s	Sat 21	...	Mon 21	...	Thu 21	...	Sat 21	...	Tue 21	...	Mon 21	M M M	Fri 21	...	Sun 21	s s s	Wed 21	...	Fri 21	s s s	Mon 21	M M M
Mon 22	M M M	Thu 22	...	Thu 22	s s s	Sun 22	...	Tue 22	M M M	Fri 22	...	Sun 22	...	Wed 22	...	Sat 22	...	Mon 22	s s s	Thu 22	...	Sat 22	s s s	Tue 22	...	Tue 22	...
Tue 23	...	Fri 23	...	Fri 23	s s s	Mon 23	...	Wed 23	...	Sat 23	...	Mon 23	...	Thu 23	...	Sun 23	...	Tue 23	s s s	Fri 23	...	Sun 23	s s s	Wed 23	...	Wed 23	...
Wed 24	...	Sat 24	...	Sat 24	s s s	Tue 24	M M M	Thu 24	...	Sun 24	...	Tue 24	...	Fri 24	...	Mon 24	...	Wed 24	s s s	Sat 24	...	Mon 24	s s s	Thu 24	...	Thu 24	...
Thu 25	...	Sun 25	...	Sun 25	s s s	Wed 25	...	Mon 25	...	Tue 25	...	Wed 25	s s s	Sat 25	...	Tue 25	M M M	Thu 25	s s s	Sun 25	...	Sat 25	...	Tue 25	s s s	Fri 25	...
Tue 26	...	Mon 26	...	Mon 26	s s s	Tue 26	...	Sat 26	...	Tue 26	M M M	Thu 26	s s s	Sun 26	...	Wed 26	...	Fri 26	start-	Mon 26	...	Wed 26	s s s	Sat 26	...	Sat 26	...
Sat 27	...	Tue 27	...	Tue 27	s s s	Fri 27	...	Sun 27	...	Wed 27	...	Fri 27	s s s	Mon 27	...	Thu 27	...	Sat 27	M M M	Tue 27	M M M	Thu 27	s s s	Sun 27	...	Sun 27	...
Sun 28	...	Wed 28	M M M	Wed 28	s s s	Sat 28	...	Mon 28	...	Thu 28	...	Sat 28	s s s	Tue 28	M M M	Fri 28	...	Sun 28	M M M	Wed 28	...	Fri 28	s s s	Mon 28	...	Mon 28	...
Mon 29	...	Thu 29	...	Thu 29	s s s	Sun 29	...	Tue 29	...	Fri 29	...	Sun 29	s s s	Wed 29	...	Sat 29	...	Mon 29	M M M	Thu 29	...	Sat 29	s s s	Tue 29	M M M	Tue 29	M M M
Tue 30	M M M	Fri 30	start-	Mon 30	...	Wed 30	s s s	Sat 30	...	Mon 30	s s s	Thu 30	...	Sun 30	...	Tue 30	...	Mon 30	M M M	Thu 30	...	Sun 30	s s s	Wed 30	...	Wed 30	...
Wed 31	...	Sat 31	M M M	Sat 31	...	Thu 31	s s s	Tue 31	...	Fri 31	...	Mon 31	s s s	Tue 31	...	Sat 31	...	Mon 31	...	Fri 31	...	Sun 31	s s s	Thu 31	...	Thu 31	...

22 Failures

Total Time Lost: 22.6 hours

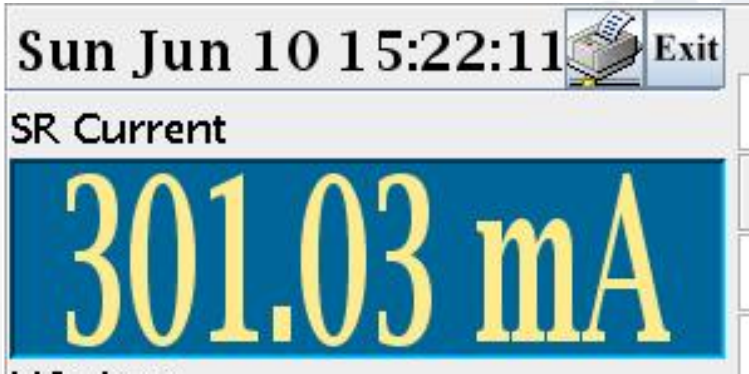
**HQPS
officially
stopped**

- Build a system of 14 units able to sustain 9.3MW during 12 seconds
- Reduced coverage of the protection (no permanent protection of the beam).
The electrical part will have to cover 3 multiple drops of less than 3 seconds.
- “Long cuts” above 3 sec are guaranteed by the public body not to append more than twice a year.
 - critical equipment powered by a genset (the old KS1 from HQPS1 refurbished 1MW power is needed after a beam dump).
- Installation finished mars 2008.
- Individual tests unit by unit: April 2008
- Site acceptance tests : May and June 2008.
- HQPS2 ready : summer 2008



Year 2007		
Run number	Week number	Hours of beam delivery without a single failure
Run 2007-01	Week 2	100
	Week 3	96
	Week 4	92
	Week 6	97
	Week 8	144
Run 2007-02	Week 1	126
	Week 2	74
	Week 3	131
	Week 5	144
	Week 6	125
	Week 8	108
Run 2007-03	Week 1	168
	Week 2	102
	Week 3	144
	Week 4	90
	Week 6	92
Run 2007-04	Week 2	168
	Week 3	114
	Week 4	89
	Week 7	94
Run 2007-05	Week 3	109
	Week 6	86





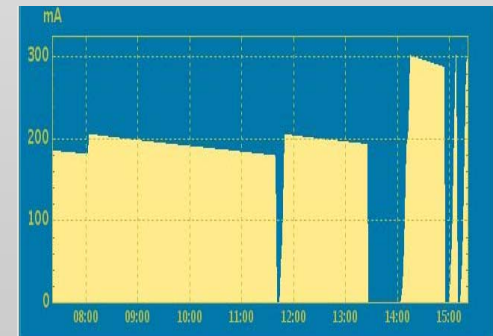
- Longitudinal feedback is operational
- 300 mA reached during MDTs in June 2007 in uniform filling mode with the longitudinal & transverse feedback
- Further test postponed due to the failure of cav5

- Ramping to 300mA will resume next run during machine time
- Machine time will later be dedicated to qualify the beamlines concerning radioprotection

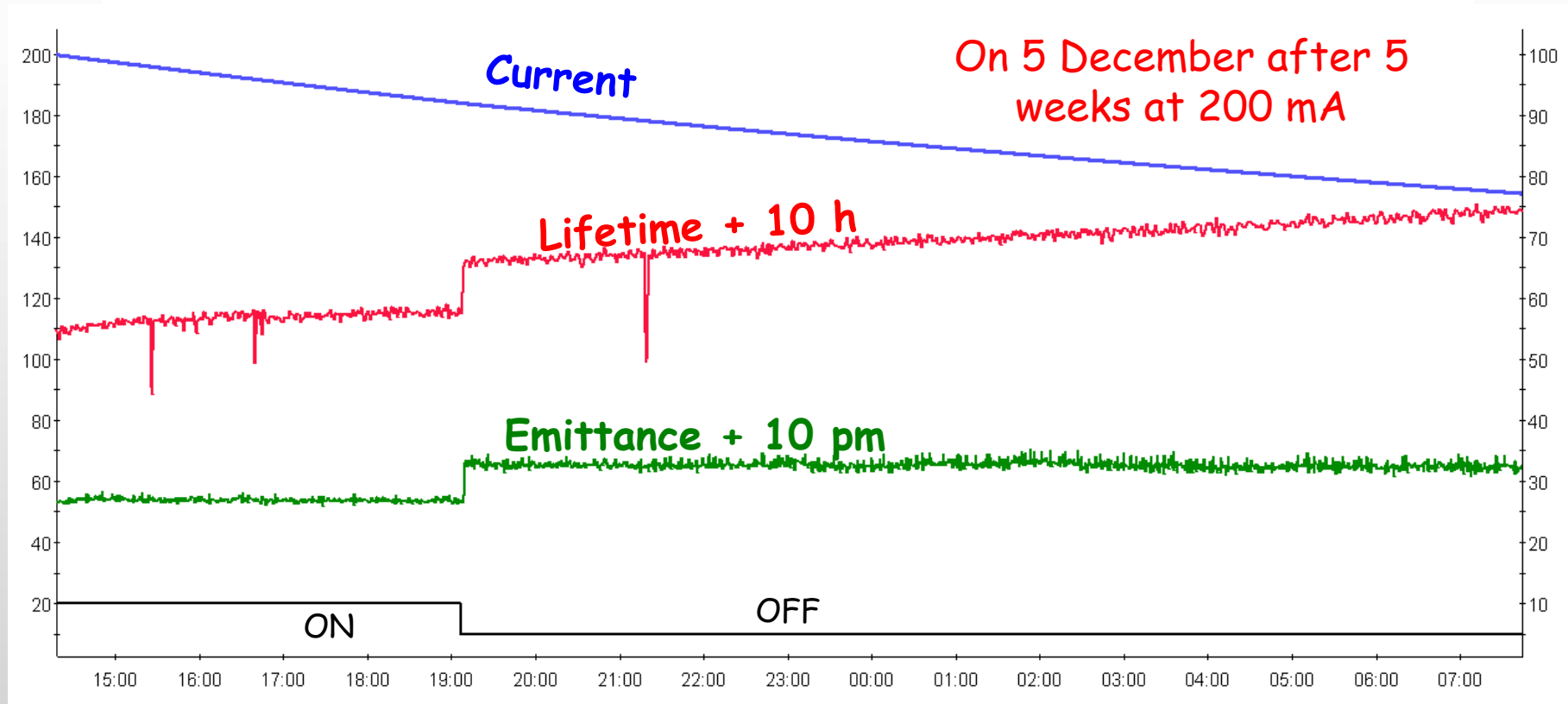
With the present policy of pre-conditioning an ID chamber before installing it on a beamline, bremsstrahlung produced in the narrow aperture ID chambers and the in-vacuum undulators (level multiplied by 9/4) will remain compatible with the maximum dose rate of 0.5 microSv/h around the hutches that corresponds to unexposed personnel within the European legislation.

- Machine time will then be dedicated to qualify the beamlines for optics and instrumentation

No redundancy for RF power source without RF upgrade

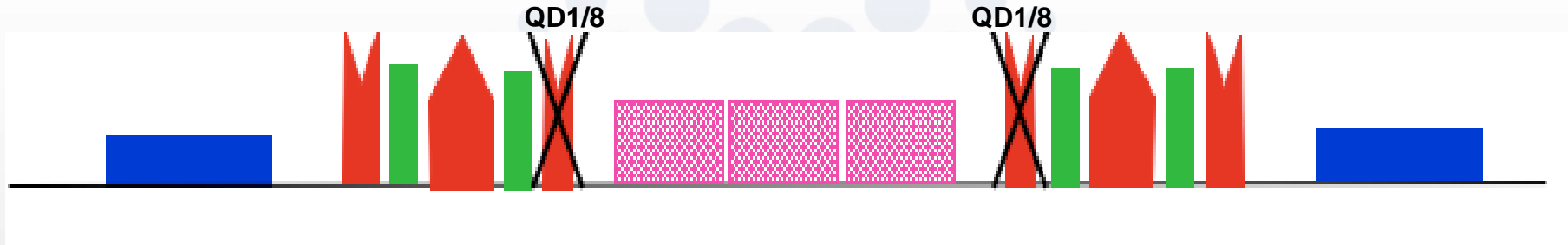


Transverse Multibunch Feedback was experimentally used during Run 2007-05 in USM in uniform to stabilize beam ion instabilities.



Transverse multibunch will from now on be permanently used during USM in uniform filling to guarantee a lower vertical emittance (but still a reduction in lifetime observed due to ions which do not escape, increase of local pressure → observation of even worse lifetime in uniform than $2^{*1/3}$ with MDT conditions).

- **Goal: Increase ID length from 5 to 6 metres**



- **First step: the 2 quadrupoles (QD1 and QD8) on each side of the IDs are not powered for all cells**

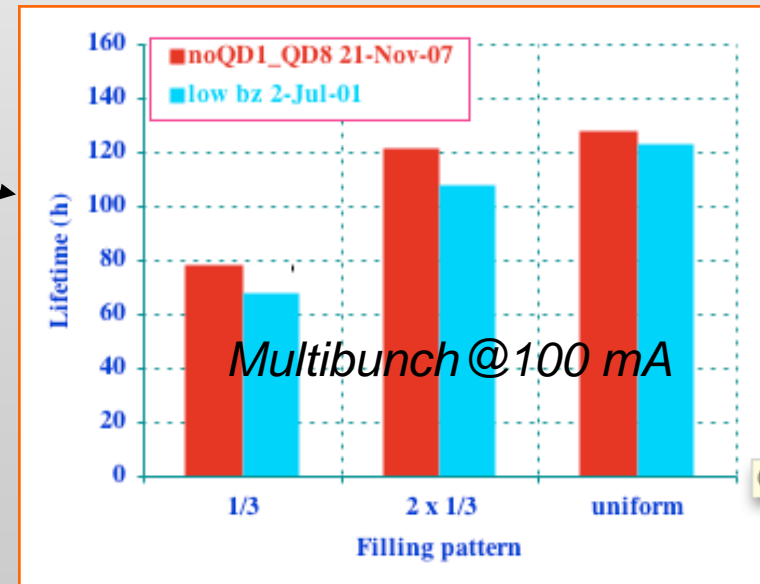
New lattice implemented in USM fall 2006

The first version of the lattice with $\beta_z = 3.5$ m $\nu_z = 12.39$ suffered from a moderate lifetime
 In 2007, a lot of efforts were dedicated to improving the lifetime

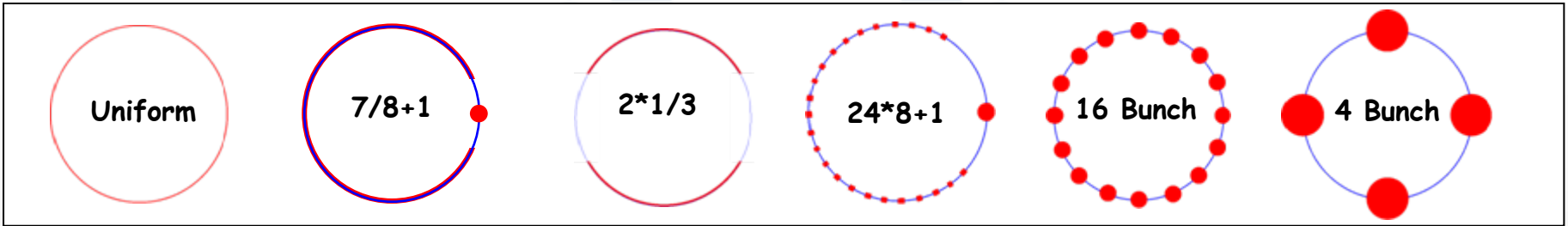
- Reduce $\beta_z = 3$ m
- Increase of the vertical tune by one integer
- Re-optimisation of sextupole settings
- ➔ Now back to nominal lifetime

- **Next step:**

Design of a CV6000 vessel (initiated)
 QD1 and QD8 removed
 6 m long IDs installed



Test will be done for the machine straight section



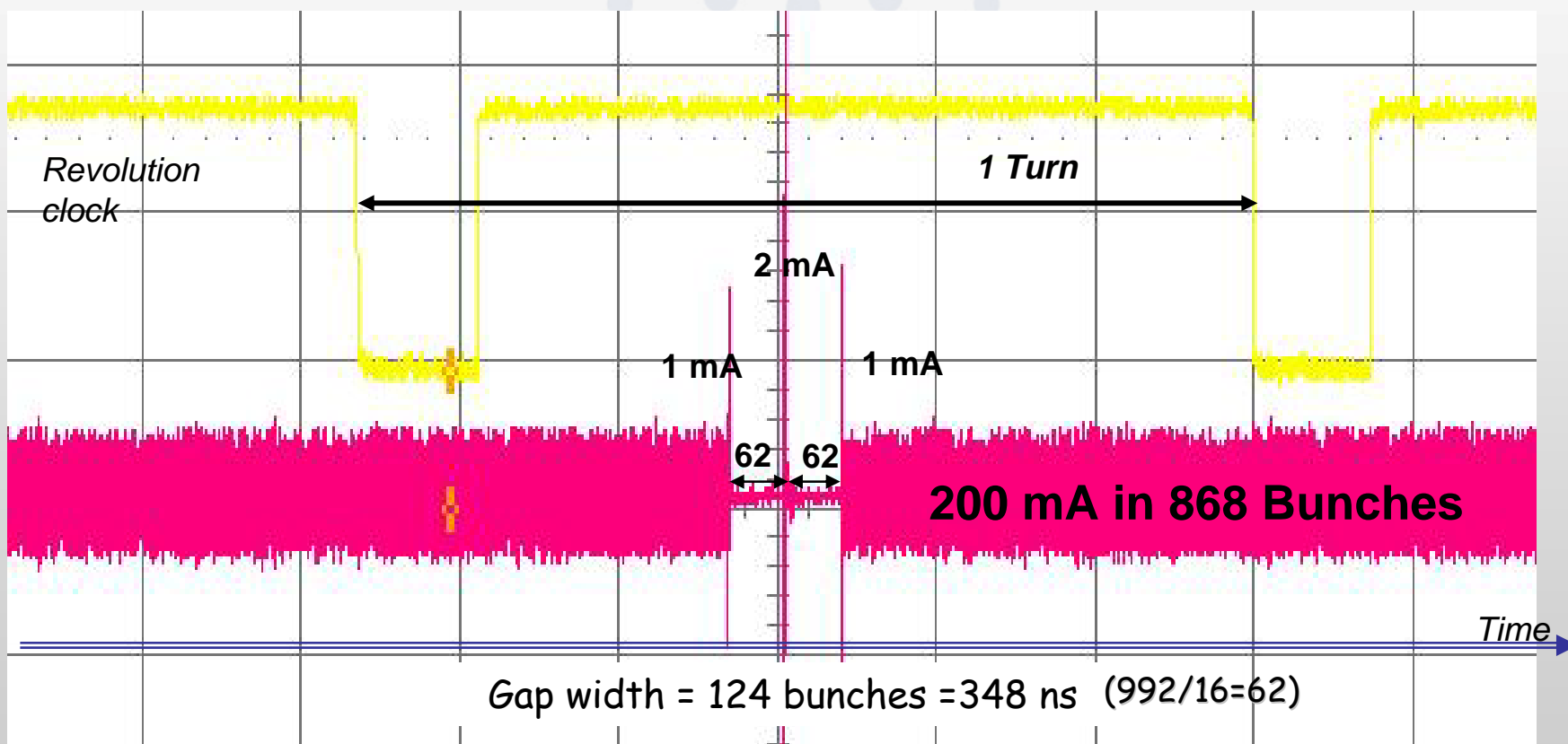
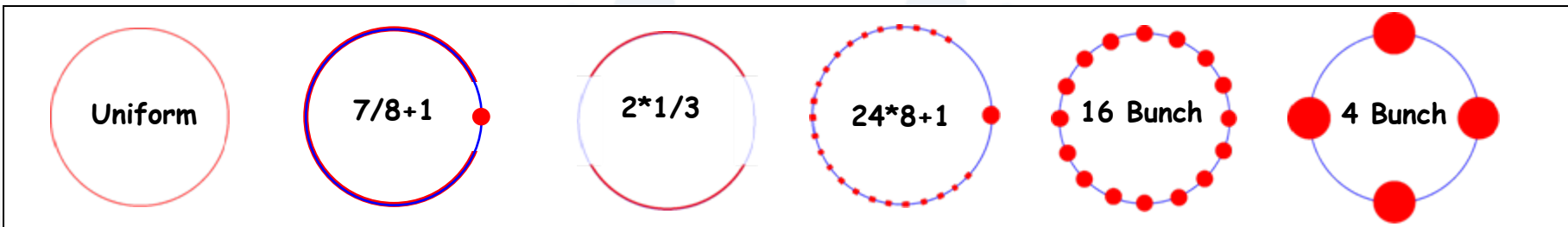
Current (mA)	Lifetime (Hours)	Refill Number	Current per bunch
-----------------	---------------------	------------------	-------------------

Multibunch

Uniform (992 bunches)	200	80	2/day	0.2 mA
7/8+1 (868 bunches)	200	72	2/day	0.23 mA & 2 mA
2*1/3 (704 bunches)	200	65	2/day	0.28 mA

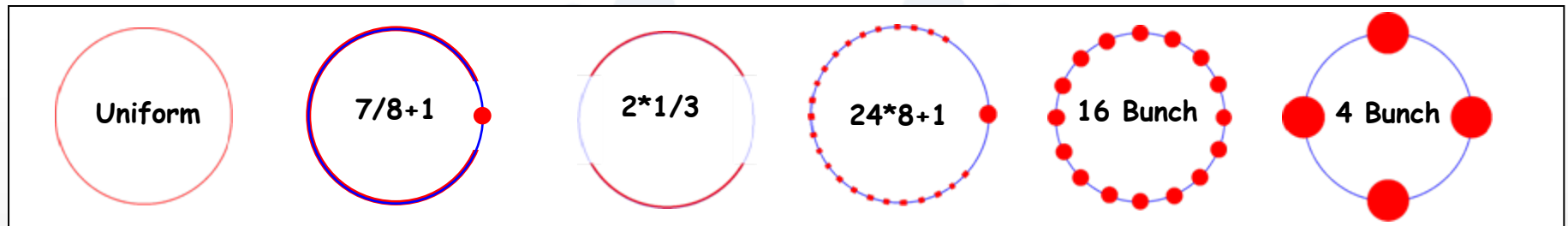
Time structure

24*8+1 Hybrid	200	30	2/day	1 mA & 4 mA
16 Bunch	90	12	4/day	5.62 mA
4 Bunch	40	6	6/day	10 mA



Gap width = 124 bunches = 348 ns (992/16=62)

Single bunch centred in the middle of the gap



Chromaticity identical to multibunch:

- Lifetime intermediate between uniform and 2*1/3 for the multibunch part
- Maximum single bunch current = 2.5 mA
 - Refill current = 2 mA, Lifetime = 15 hours

Small vertical emittance: 25 pm

No emittance growth due to ion trapping thanks to the presence of a gap

Injection time slightly longer than multibunch

(injection speed reduced by a factor 2 and cleaning process)

Cleaning performance identical to other timing modes
(for Moss Bauer experiments)

1) Pump probe experiments could be done with a filling pattern which does not penalise multibunch users.

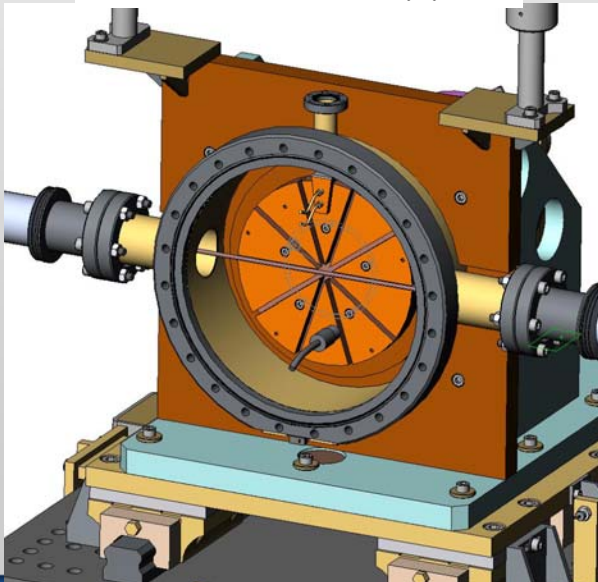
2/ lower emittance than in other timing modes (smaller and more stable focus)

3/ shorter X-ray pulse, 60-80 ps instead of 90-110 ps (16 bunch mode)

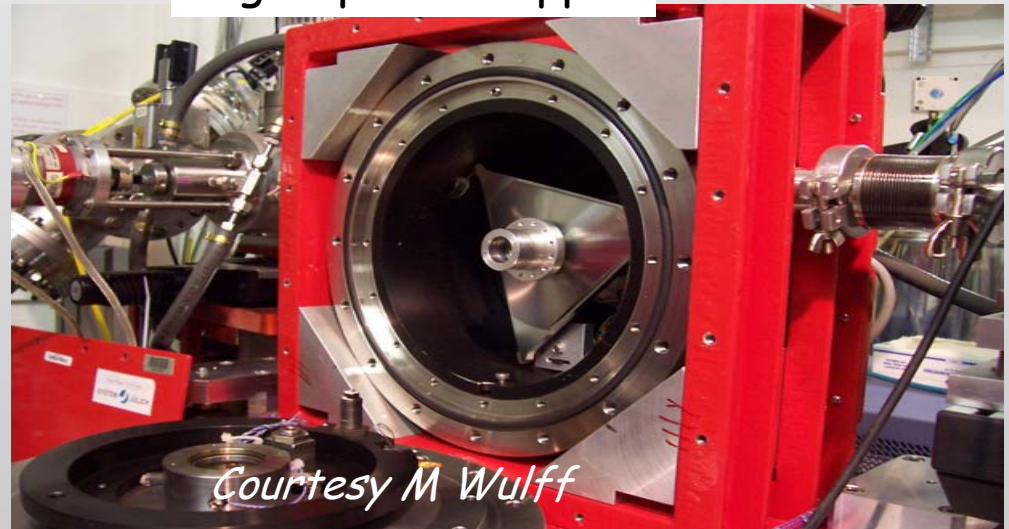
The lower bunch charge, 2 mA compensated by running some experiments at 3 kHz instead of 1 kHz.

Higher heat load at 200 mA for a timing experiment reduced by the heat load chopper.

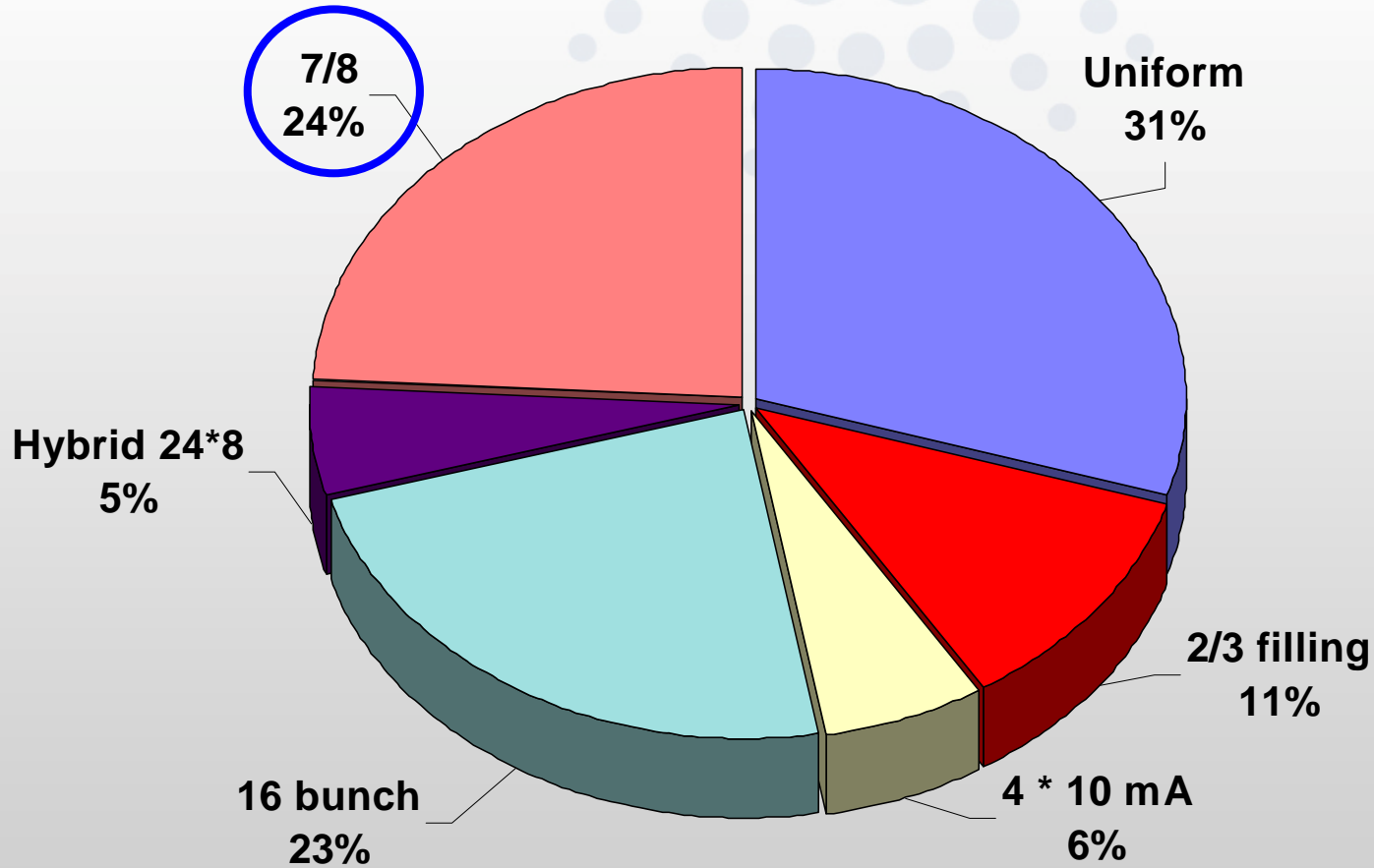
Heat load chopper



High-speed chopper



Newcomer in 2007



Current (mA)	Lifetime (Hours)	Refill Number	Current variation between refill
-----------------	---------------------	------------------	-------------------------------------

Multibunch

Uniform	200	80	2/day	<u>13%</u>
<i>2*1/3</i>	<i>200</i>	<i>65</i>	<i>2/day</i>	<i>18%</i>

Time structure

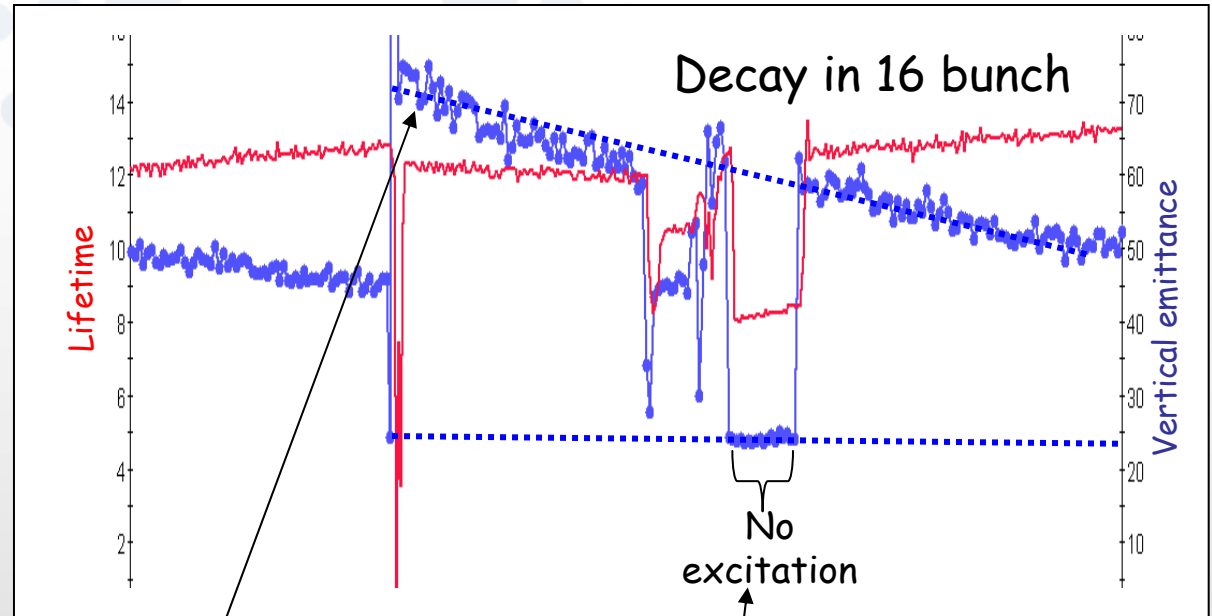
24*8+1 Hybrid	200	30	2/day	30%
16 Bunch	90	12	4/day	44%
4 Bunch	40	6	6/day	50%

Beam current variation

- Variation of thermal load on the beamline optics
- Variation of beam characteristics

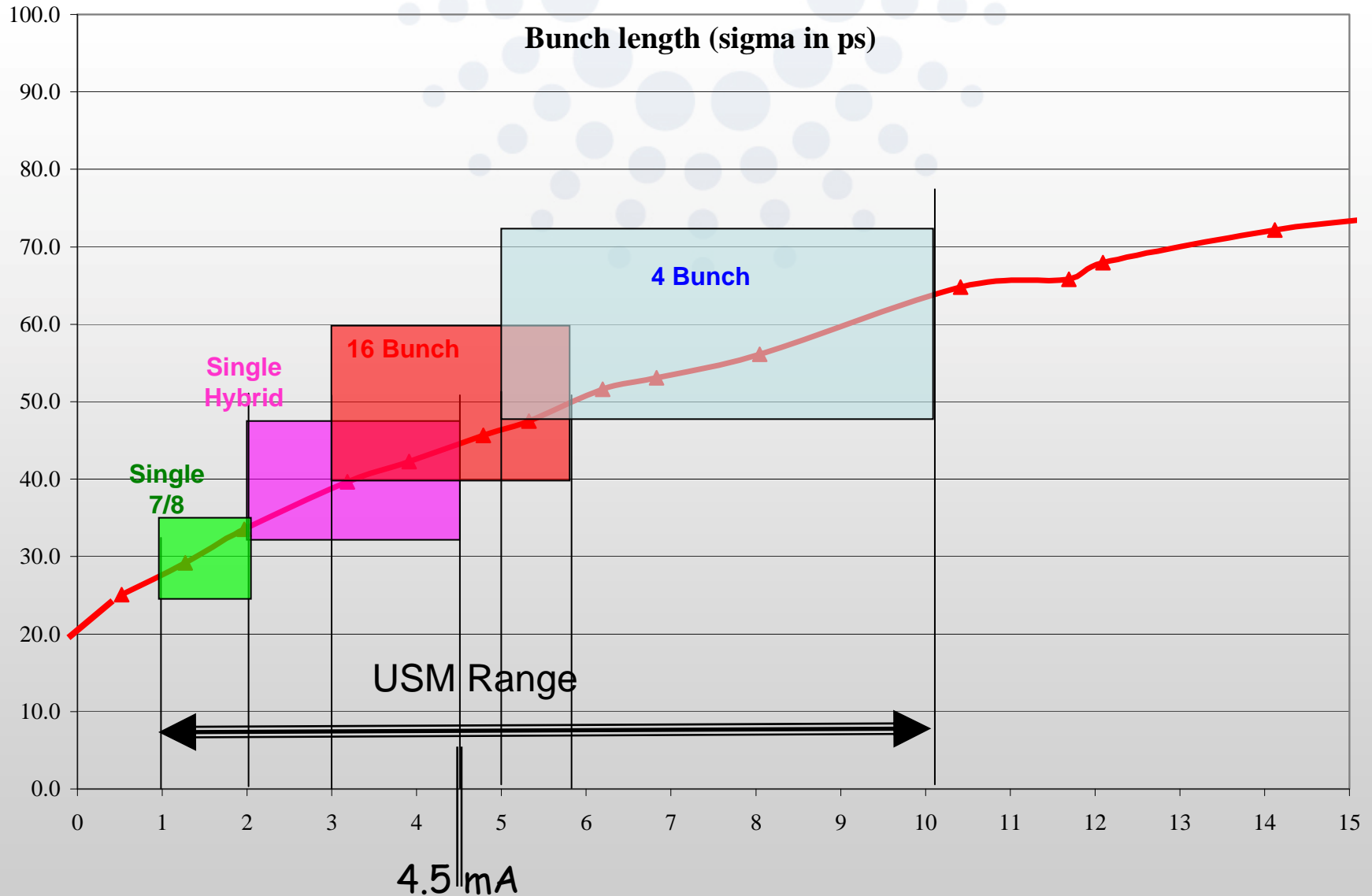
(Position, emittances, energy spread, bunch length and **position stability**)

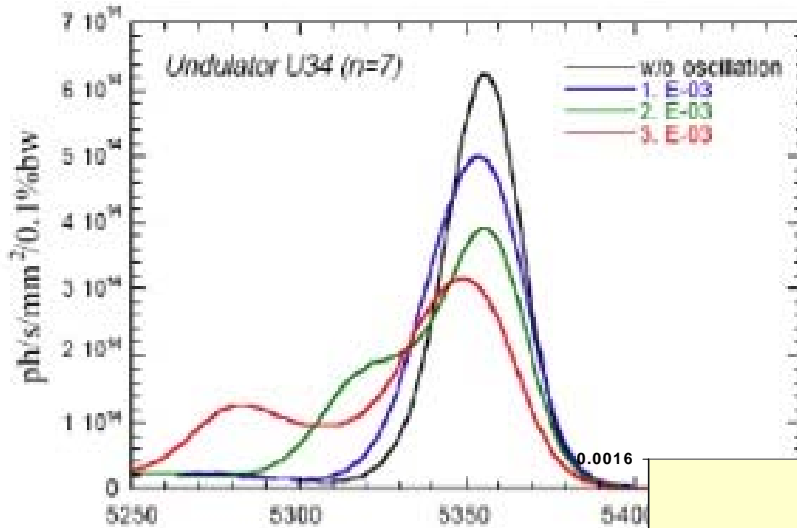
In order to increase the lifetime (factor 2) the vertical emittance is blown up using vertical transverse excitation.



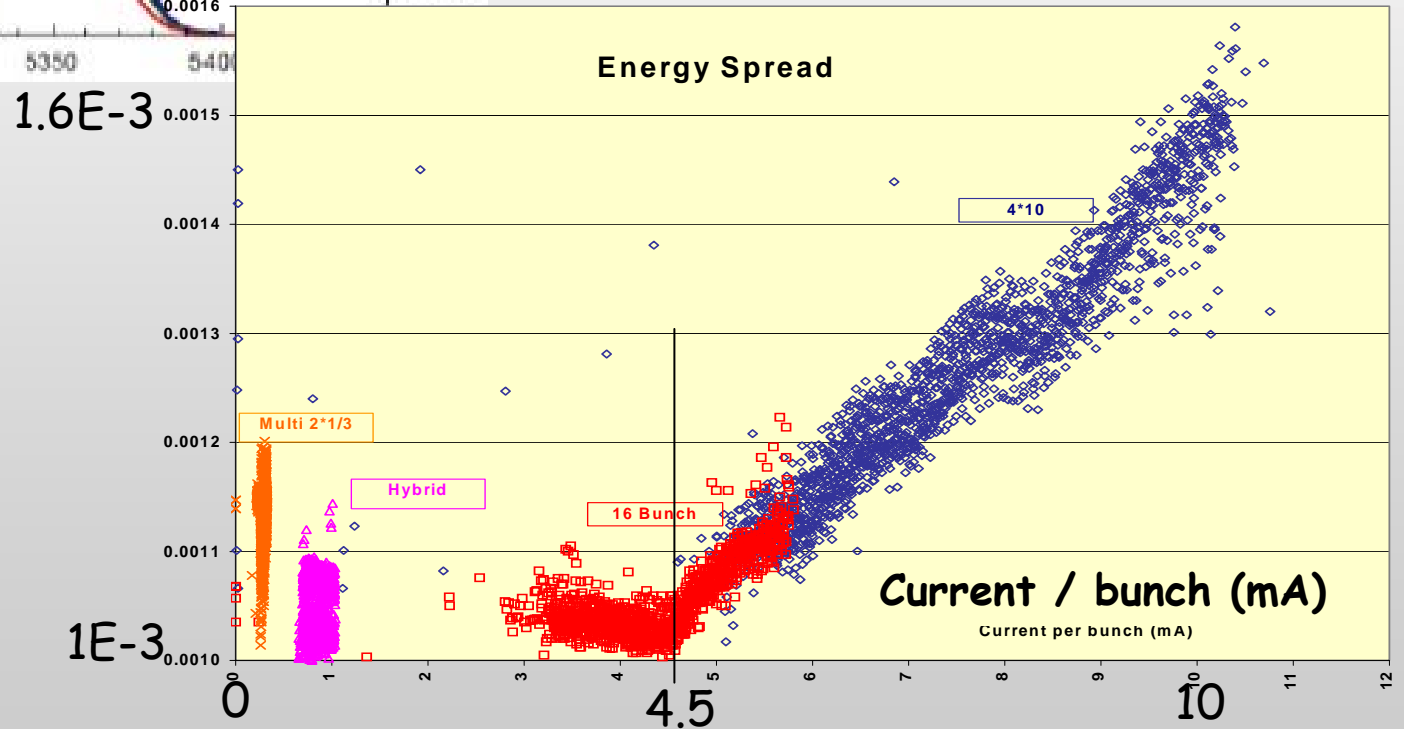
Vertical emittance: 70 pm (with excitation) → 20 pm

4 Bunch	3h30	→	6h
16 Bunch	6h30	→	12 h
Hybrid:	18h	→	30 h





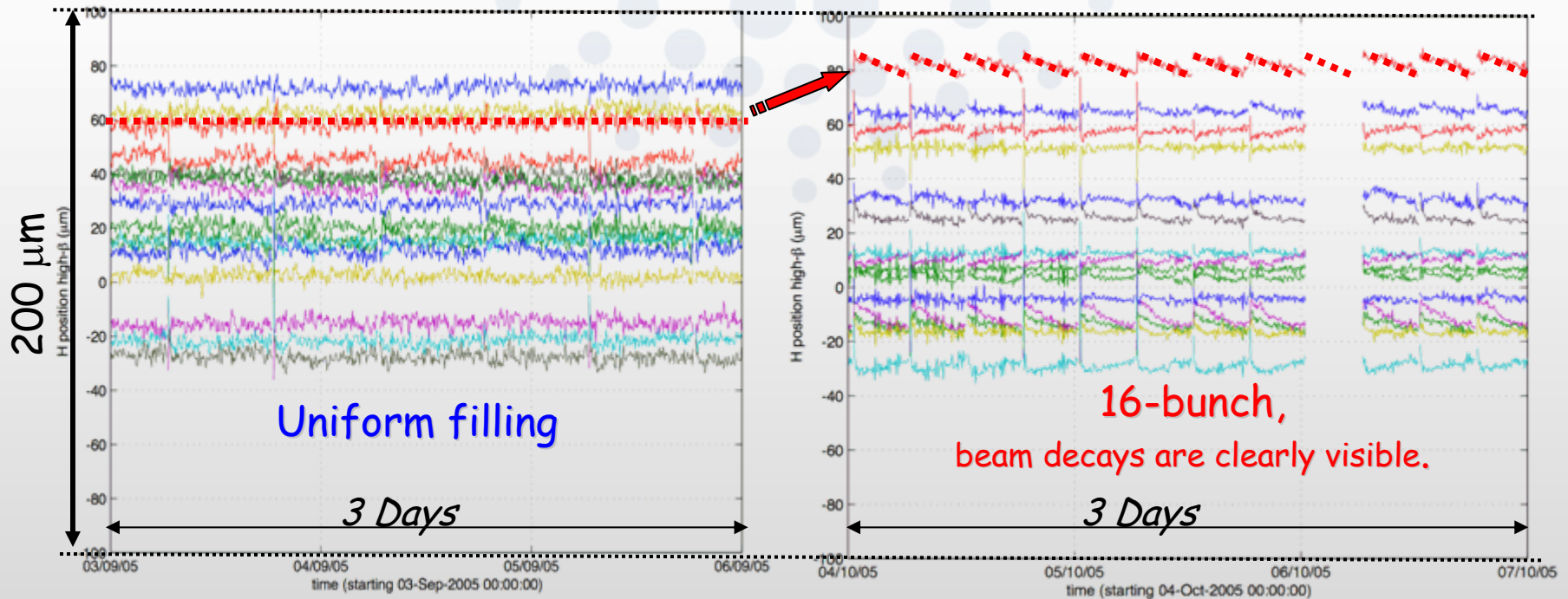
Energy spread increase induced by longitudinal instability in single bunch



Electron beam position stability is affected by the varying heat-load resulting from the beam decay:

- ✓ Quadrupoles are displaced by a few tenths of μm due to thermal deformations of the vacuum chamber:
 - $35\mu\text{m}$ rms beam motion (*from 0 to 200 mA*), corrected by slow orbit feedback.
- ✓ Beam Position Monitors (BPMs) are also displaced by the same effect:
 - Identical to quadrupole motion but $0.5\ \mu\text{m}$ → negligible.
- ✓ BPM readings are sensitive to the beam intensity:
 - Compensated using a feed forward calibration.

Horizontal absolute position in all straight sections over 3 days: the real picture



The correction has limits: it evolves with time, it depends on the filling pattern (worse in 16 bunch), on BPM maintenance...

Better stability with reduced current variation from an operational point of view (correction, calibration...).
However the final figure will not differ from today's in multibunch.

We are already operating in topping up mode.....with a repetition rate of a few times per day .

Improvement in progress for all modes :

- 1) The in-vacuum gap will not be open during topping up.
- 2) Position perturbation during topping up has to be reduced.

For multibunch:

- 3)The frequency of topping up could be increased if needed.

For time structure modes:

- 5) Topping up frequency must be increased to compensate for the short lifetime and to stabilize the beam parameters (Better stability and no beam blow up necessary for a decent lifetime) → Refill every 5 minutes is envisaged
- 6) Cleaning in the injector is still under development.
- 7) Machine physics studies on the injector are in progress.
- 8) An upgrade of the booster power supply is part of the upgrade programme
(No current increase foreseen in time structure, limited by heat load induced in the RF fingers).

Stability Criteria:

Emittance growth < 20%

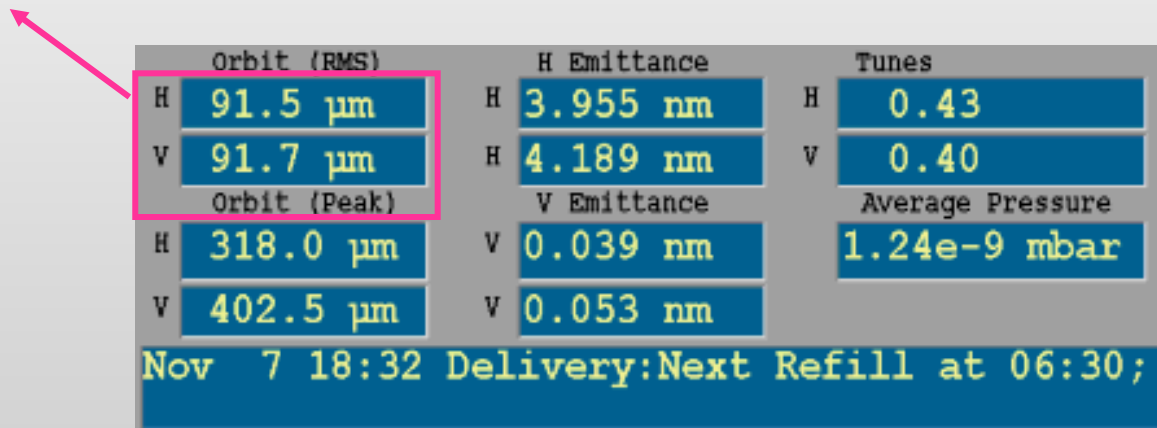
→ 10% on beam size and 10% on beam divergence

	<i>Horizontal</i>	<i>Vertical</i>
Emittances	4 nm	30 pm
β function	35 m	3 m
Beam size	380 μm	9 μm
Required stability	38 μm	0.9 μm

The electron beam position is continuously measured at 224 positions around the ring with a resolution of 1 μm with averaging.

This deviation from the reference orbit is minimized by a global correction by SVD method, which is computed every 30 sec.

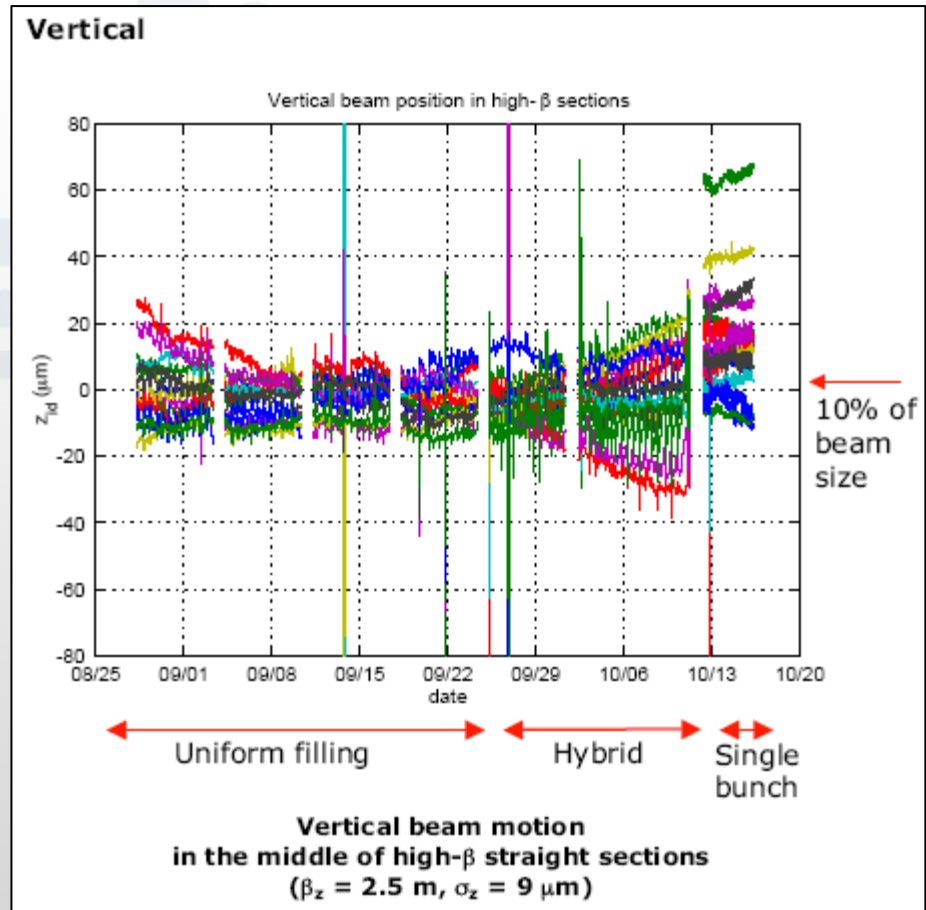
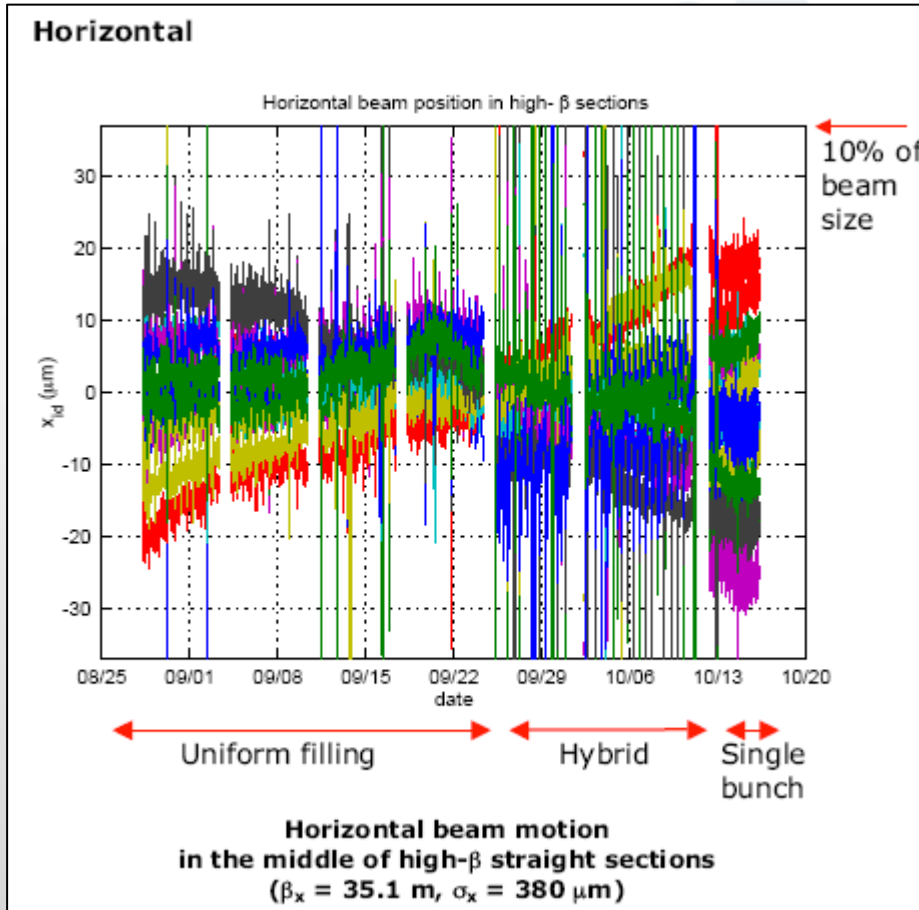
The correction is applied at 96 positions in each plane using steerer magnets.



Orbit (RMS)		H Emittance	Tunes
H	91.5 μm	H 3.955 nm	H 0.43
V	91.7 μm	H 4.189 nm	V 0.40
Orbit (Peak)		V Emittance	Average Pressure
H	318.0 μm	V 0.039 nm	1.24e-9 mbar
V	402.5 μm	V 0.053 nm	

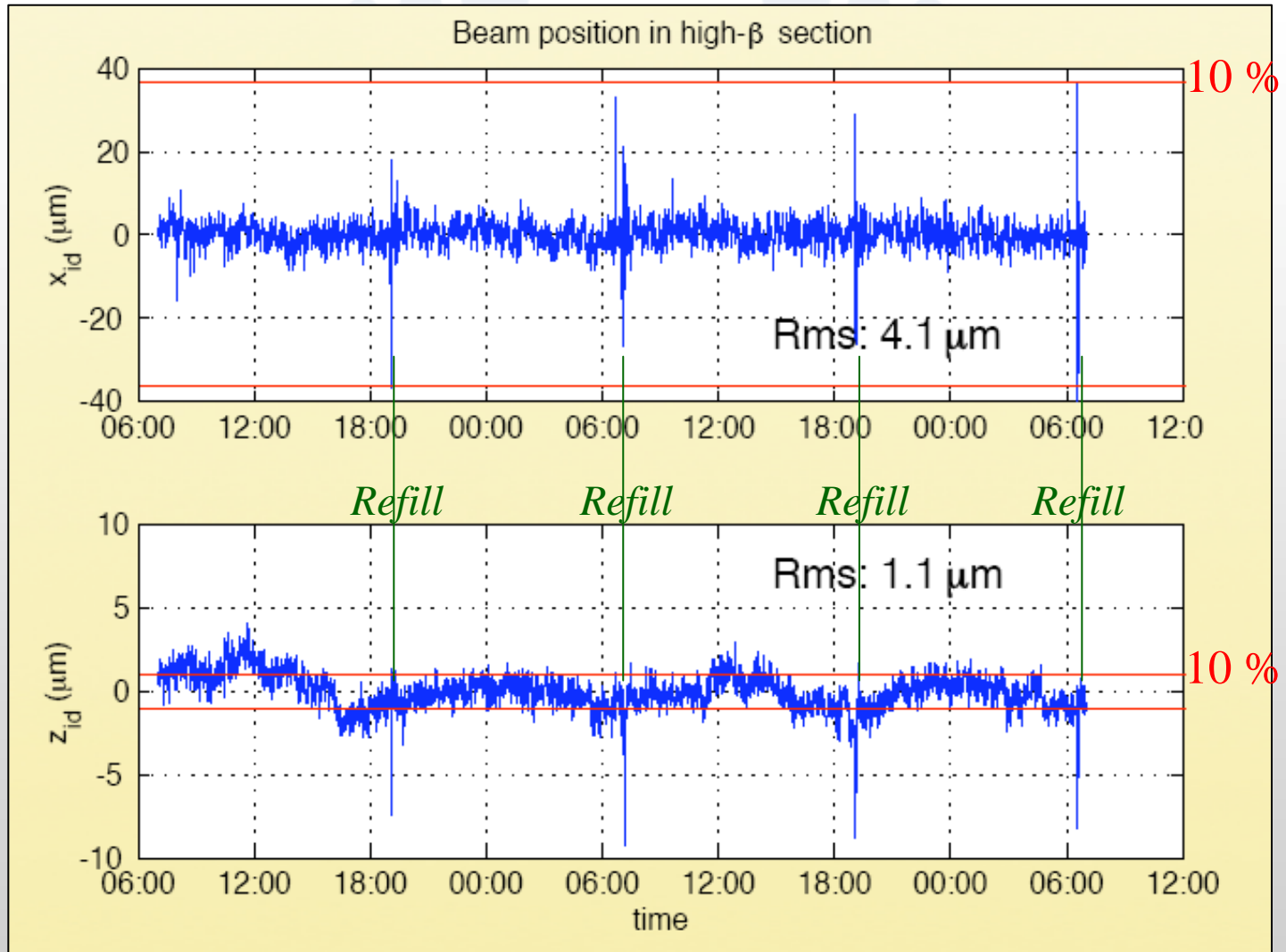
Nov 7 18:32 Delivery:Next Refill at 06:30;

The offset of the BPM and the calibration of drifts with beam intensity are periodically updated



- Within 10% of horizontal beam size for more than 6 weeks
- Visible influence of the filling pattern

- Exceed 10% of beam size over long term
- Influence of the filling pattern
- Problem of referential: the ground itself is not an absolute reference in that range.



The stability is corrected by the permanent closed orbit correction.

Fast horizontal and vertical global feedback reduce the noise in a bandwidth from 0.1 to 150 Hz:

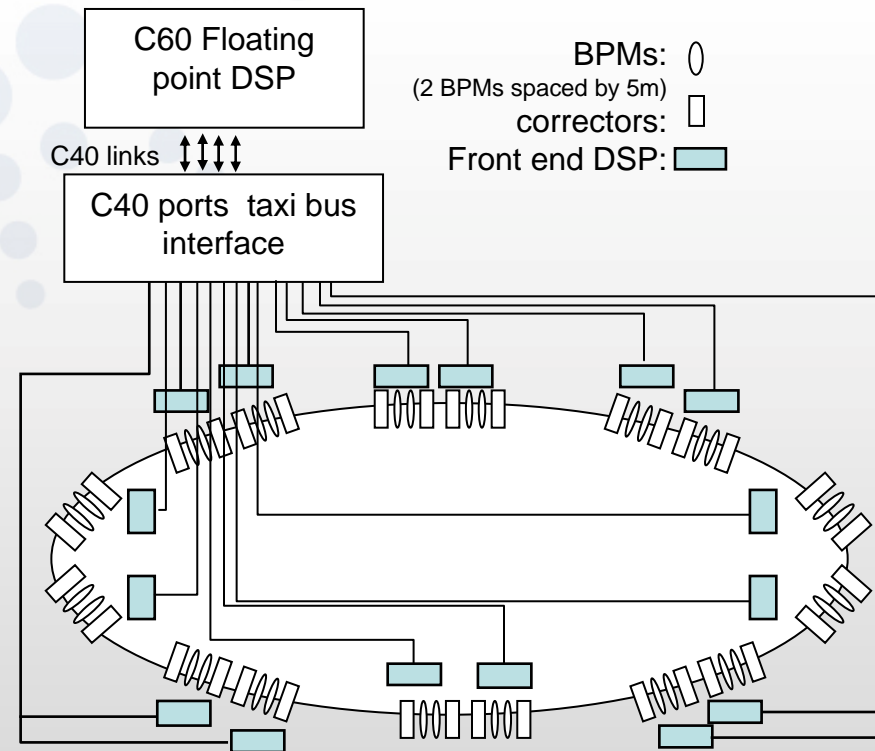
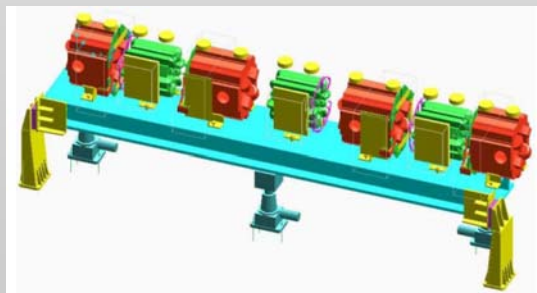
H: 32BPMs and 32 correctors

V: 16BPMs and 16 correctors,

4.4 kHz correction rate

Gain = 4 in horizontal

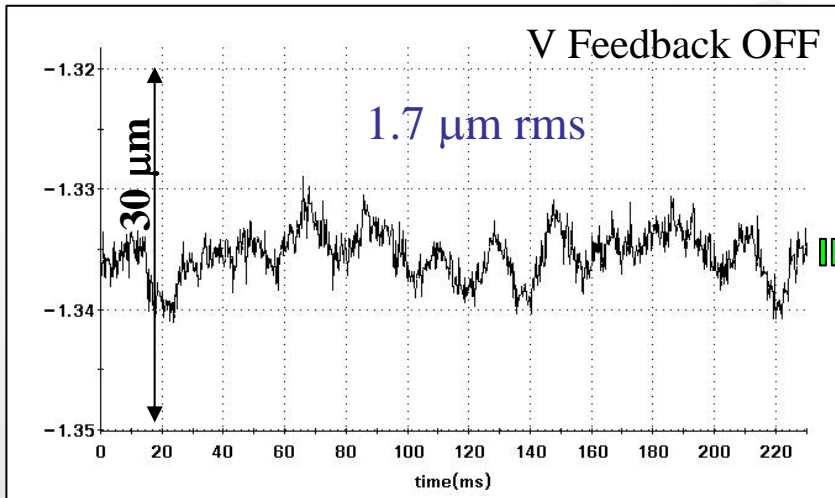
Gain = 2 in vertical



Damping material are located on each side of the girders to reduce vibration effects

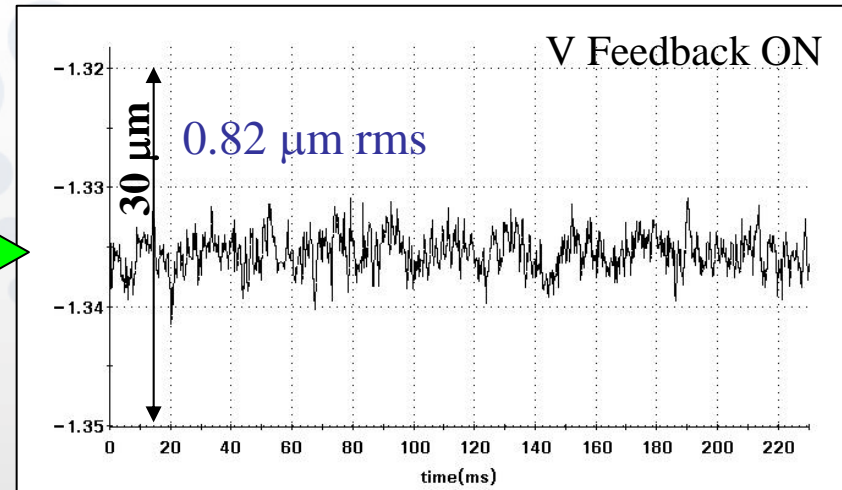
Gain of 3 in the horizontal plane.

Vertical electron fast beam motion

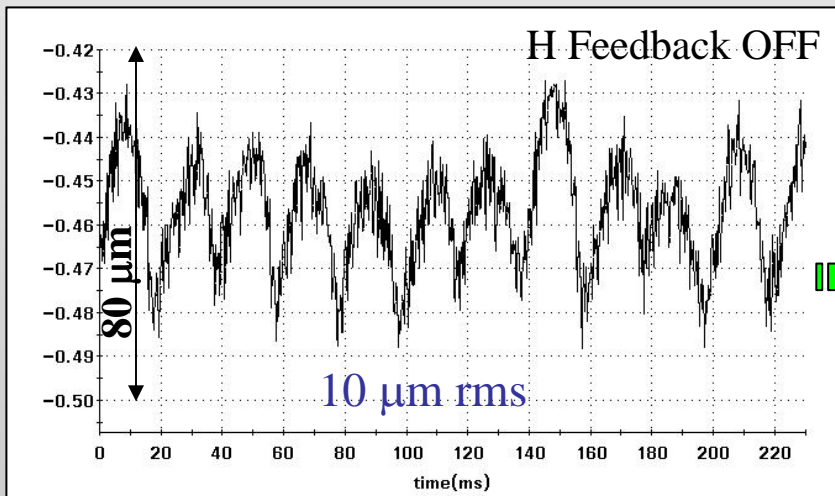


Gain 2

Vertical electron fast beam motion

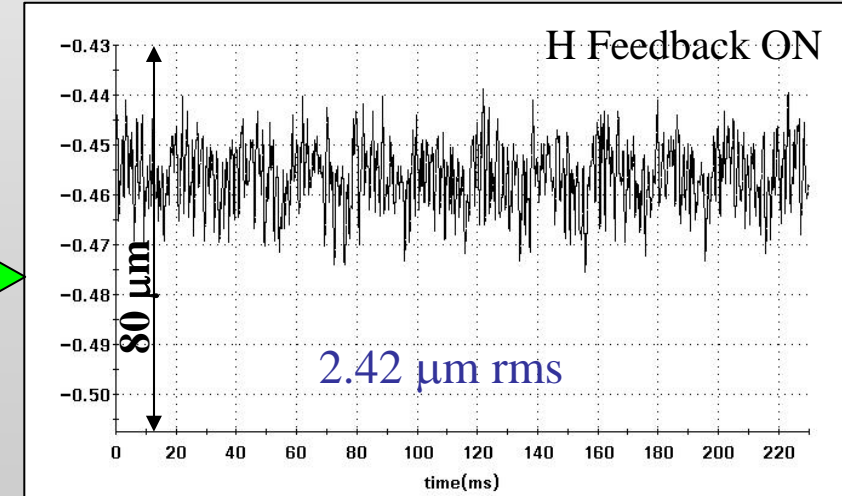


Horizontal electron fast beam motion



Gain 4

Horizontal electron beam fast



Typical RMS beam motion in high beta straight sections

	<i>Horizontal</i>	<i>Vertical</i>
10% of Beam size	38 μm	0.9 μm
<i>One week</i>	11 μm	8 μm
<i>One day</i>	5 μm	2 μm
<i>One hour</i>	5 μm	2 μm
<i>One minute</i>	5 μm	2 μm
<i>One second</i>	2 μm	1 μm

A combination of slow control, mechanical damping links and fast global feedback brings the vibration and the slow motion to an acceptable level.

The amplitude of very slow motion is still dominant.

File

Signal Options...

Graph Options...

Save Data to File...

Mon Jan 14 15:00:00 2008

Tmin

14/01/08 15:00:00

Tmax

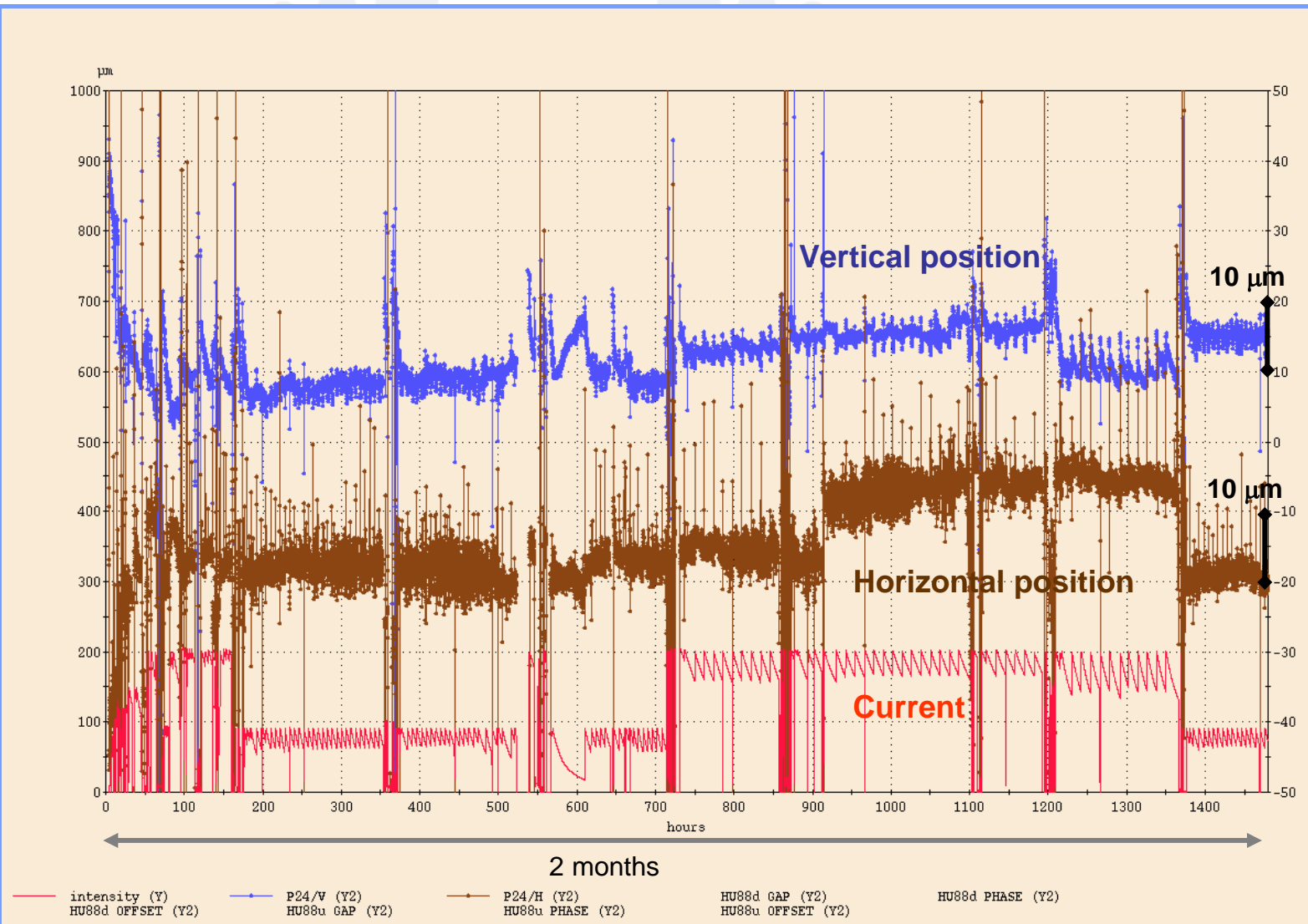
16/03/08 07:00:00

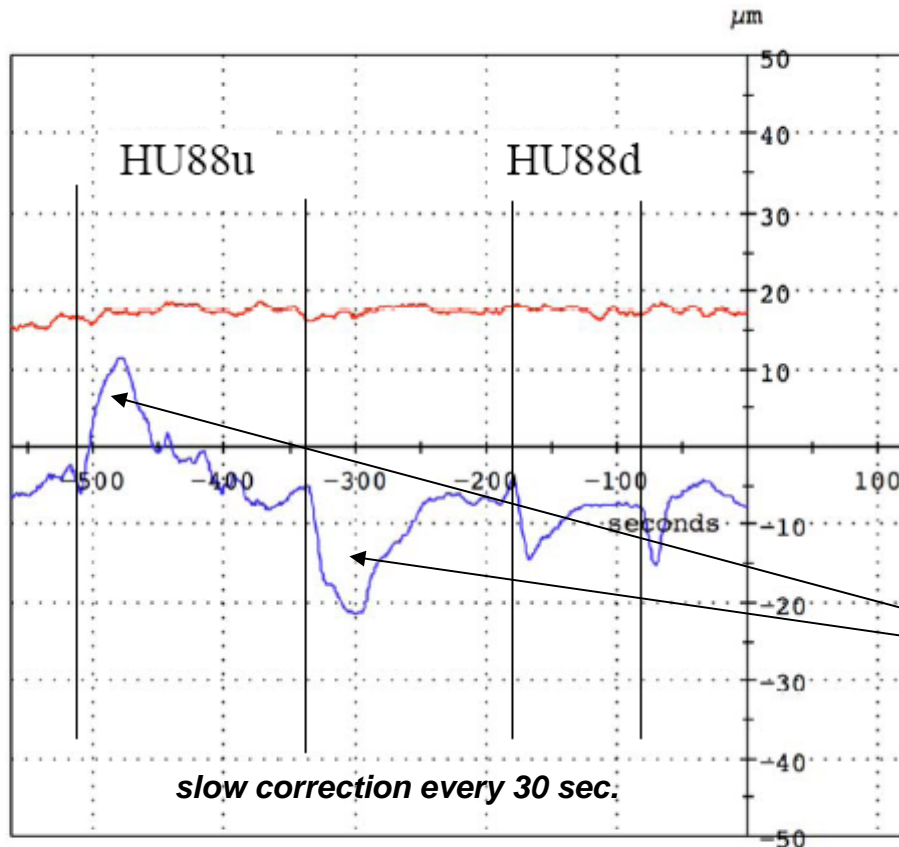
Ymin

Ymax

Y2min

Y2max





Vertical and horizontal orbit perturbation in straight section 24 when the phases of the undulators in straight section 8.

(Extreme conditions and feed forward corrections of the undulators are switched OFF)

The orbit perturbations are due to the dead band between the slow and the fast correction systems.

Solution under investigations:

**Single position feedback system
from DC to 150 Hz**

BPM electronics, the existing system :

Still works properly & reliably, after > 15 years of loyal service . .

→ but first turn mode needs 4*5 mA from the injector, which may caused too high level of radiation and will block the instigations (*safety regulation has drastically evolve since 1992*).

→ Need of a low current , pure single shot BPMs electronics

→ Solution:

Libera system which now equiped :

Diamond, Soleil, Elettra, Alba, Petra-3, Delta and some other major Accelerators outside Europe

with a Turn-Key BPM system for both Slow & Fast orbit measurement



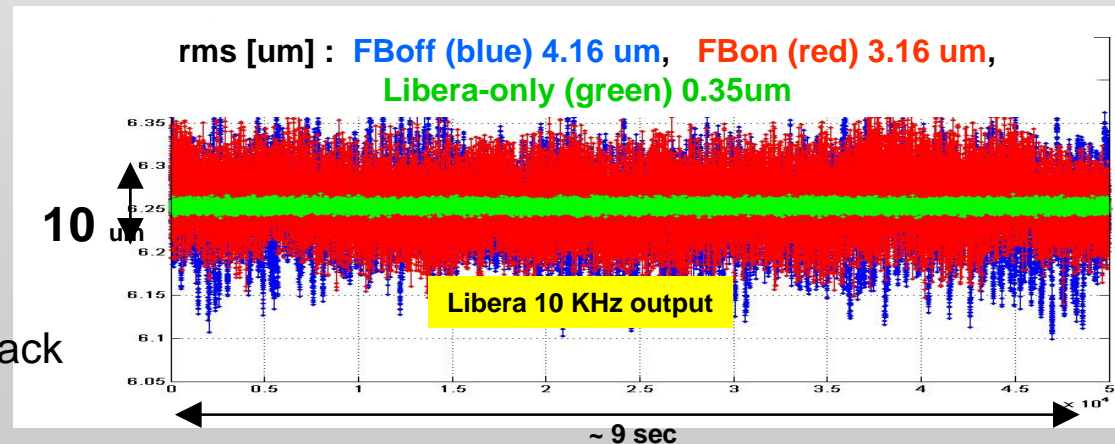
The "**Libera**" :

- Fully integrated turn-key solution for signal acquisition & treatment of BPM signals.
- Measures weak signals with high quality RF electronics & Digital Signal Processing techniques to calculate the electron beam position with high precision, resolution and stability.
- Maintain an un-precedented stability of this position measurement over a large dynamic range (= 0.1 to 300mA beam current in the ESRF Storage Ring)
- In addition to measure the slow beam position (10Hz) it also provides :
 - First-Turn and Turn-by-Turn outputs (355KHz)
 - high-resolution 10KHz output for use in Fast-Orbit-Feedback schemes

Status: 8 electronics installed for qualification and later to be used for beam position interlocks.

The 224 existing electronics will be upgraded to LiberAs within the upgrade programme

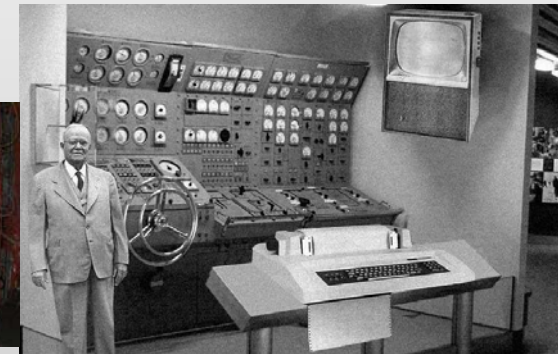
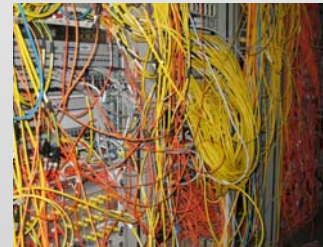
→ 224 signals for the fast orbit feedback instead of the existing 32 inputs



- The ESRF accelerator control system has evolved to an object oriented distributed control system TANGO from 2000 (*Old system TACO and new system still cohabit*)
- Evolution of computing market
 - obligation to be more heterogenic to fulfil the technical requirements
- The compromise between standardisation and modernity is today extremely difficult.
 - Evolution is mandatory in order not to be rapidly obsolete

<http://www.tango-controls.org/>

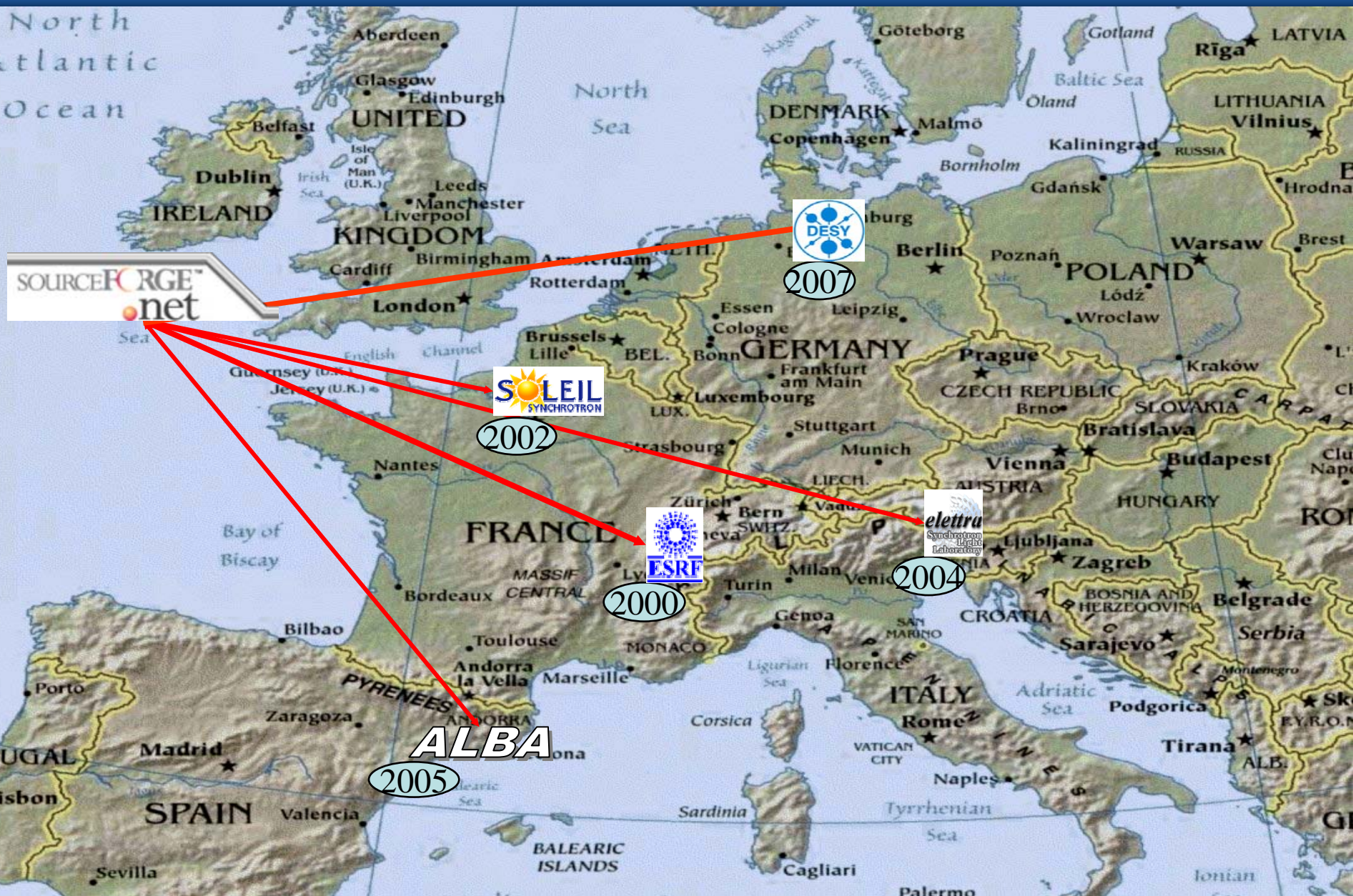
- Embedded control system is today the direction of evolution

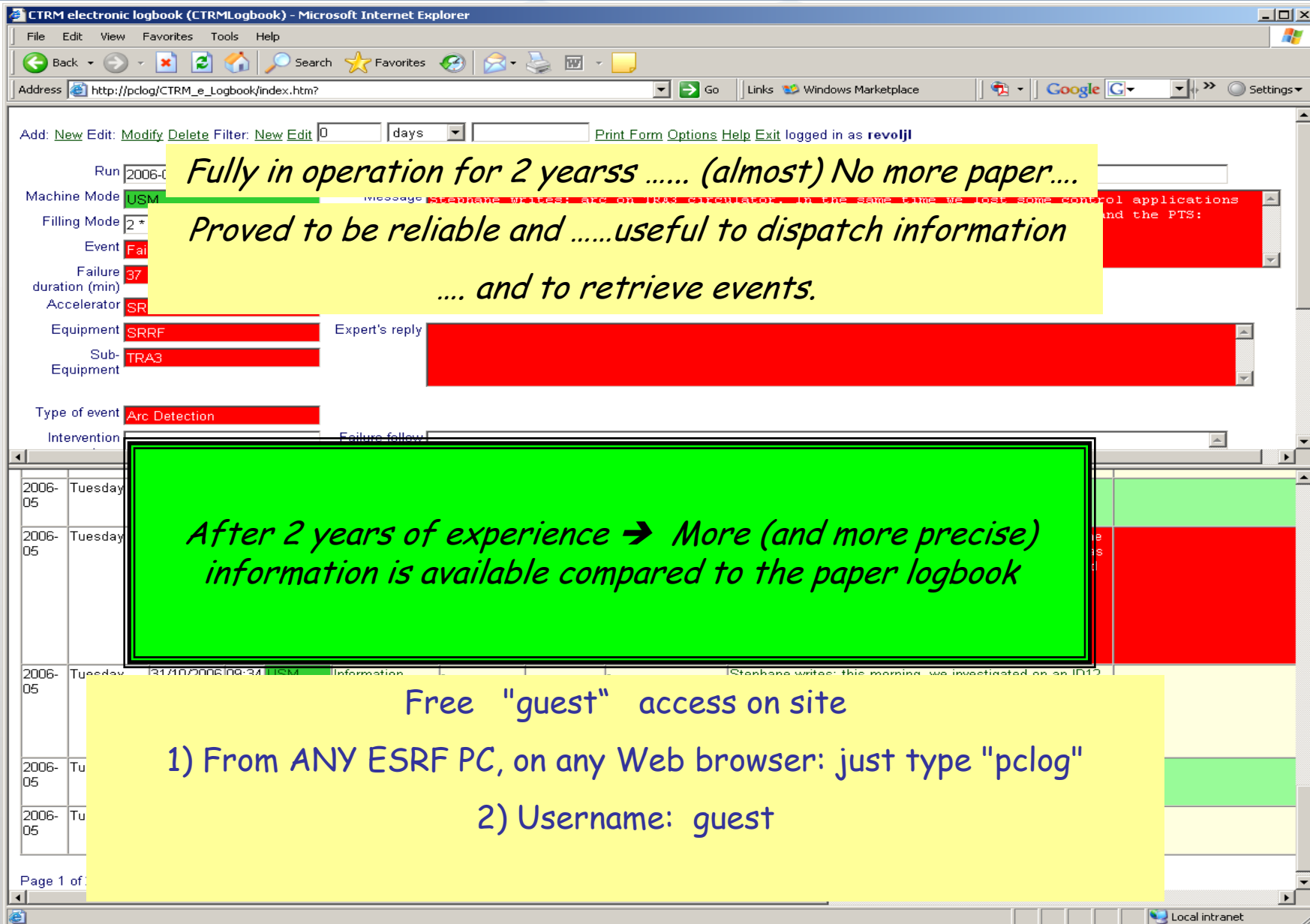


Scientists from the RAND Corporation have created this model to illustrate how a "boom computer" could look like in the early 1950s.

Despite its complexity the machine control system is extremely reliable thank to the close collaboration between the ASD and CS

Four hours of machine time with beam are purely dedicated each run to control activities





CTRM electronic logbook (CTRMLogbook) - Microsoft Internet Explorer

Address: http://pclog/CTRM_e_Logbook/index.htm?

Add: [New](#) Edit: [Modify](#) [Delete](#) Filter: [New](#) [Edit](#) 0 days [Print Form](#) [Options](#) [Help](#) [Exit](#) logged in as **revoljl**

Run: 2006-05-05

Machine Mode: USM

Filling Mode: 2*

Event: Fail

Failure duration (min): 37

Accelerator: SR

Equipment: SRRF

Sub-Equipment: TRA3

Type of event: Arc Detection

Intervention: Failure follow-up

2006-05-05	Tuesday	13:14:10,2006-05-05 13:14:10	USM	Information	Stephane writes: this morning, we investigated an IP12
2006-05-05	Tuesday				
2006-05-05	Tuesday				
2006-05-05	Tuesday				

Page 1 of 1

Local intranet

*Fully in operation for 2 yearsss (almost) No more paper....
Proved to be reliable anduseful to dispatch information
.... and to retrieve events.*

After 2 years of experience → More (and more precise) information is available compared to the paper logbook

Free "guest" access on site

- 1) From ANY ESRF PC, on any Web browser: just type "pclog"
- 2) Username: guest

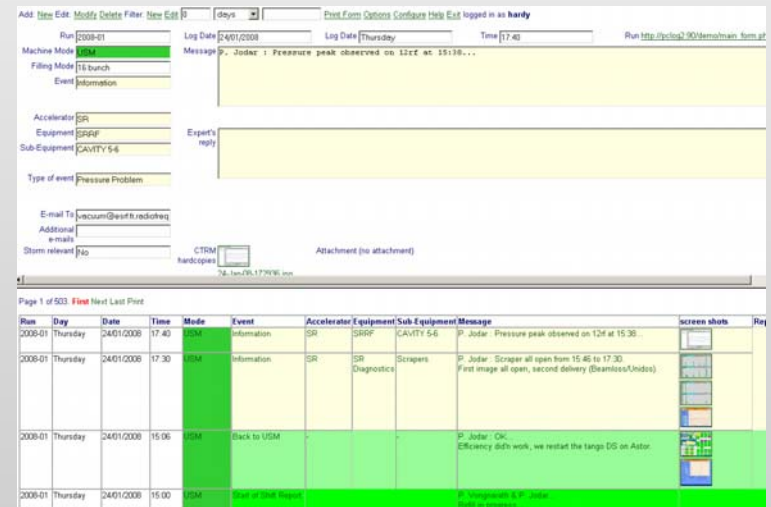
Present situation:

- 13 different logbooks are being routinely used (including the MX macromolecular Group)
- On 23/01/2008:
 - 10 000 records entered in the CTRM electronic Logbook
 - 2560 documents entered in the AS Division
 - Extensively used by many groups (within and outside the ASD)
- VERY strong request from several beamlines to have the same logbook

In about 2-3 months:

A new version will be installed with
a link to the ESRF Tango control System

➔ Possibility to import automatic data on Operator's request and possibility to generate automatically records « on events » triggered by predefined criteria



The screenshot displays the ESRF electronic logbook interface. At the top, there are navigation and search options. Below that, a list of events is shown with columns for Run, Day, Date, Time, Mode, Event, Accelerator, Equipment, Sub-Equipment, Message, and screen shots. The events listed are:

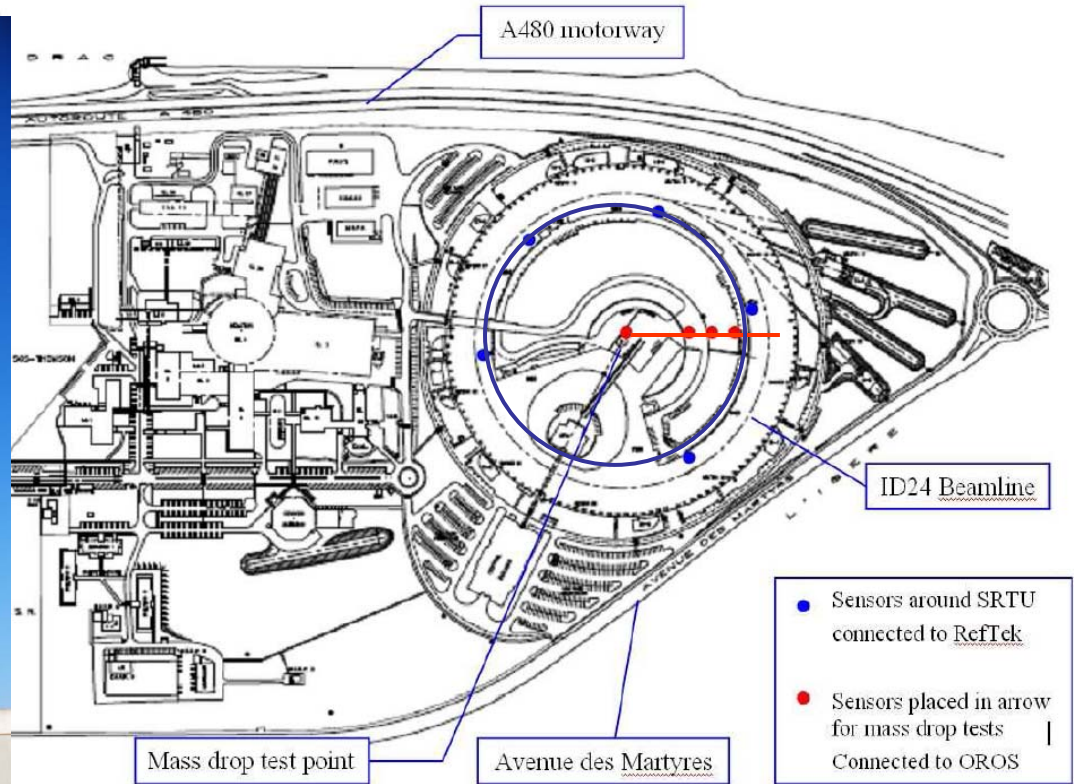
Run	Day	Date	Time	Mode	Event	Accelerator	Equipment	Sub-Equipment	Message	screen shots	Re
2008-01	Thursday	24/01/2008	17:40	SDM	Information	SR	SRRF	CAVITY 5-6	P. Jodar : Pressure peak observed on 12rf at 15:30...		
2008-01	Thursday	24/01/2008	17:30	SDM	Information	SR	SR	Scrapers	P. Jodar : Scrapers all open from 15:45 to 17:30. First image all open, second delivery (Beamless/locks)		
2008-01	Thursday	24/01/2008	15:06	SDM	Back to USM				P. Jodar : OK. Efficiency 40% work, we restart the tango DS on Astor.		
2008-01	Thursday	24/01/2008	15:00	SDM	Start of shift session				P. Jodar : OK. Efficiency 40% work, we restart the tango DS on Astor.		

The interface also shows a detailed view of a selected event, including fields for Machine Mode (CTRM), Filling Mode (IS bunch), Event Information, Accelerator (SR), Equipment (SRRF), Sub-Equipment (CAVITY 5-6), Type of event (Pressure Problem), and E-mail To (bcicum@esrf.fr).

A dramatic photograph of a lightning bolt striking a building. The lightning bolt is a bright, jagged white-yellow streak descending from a dark, stormy sky. It strikes the roof of a long, low building with a white cylindrical tower. In the foreground, a parking lot contains several cars, including a silver sedan and a dark SUV. The background shows hazy mountains under a grey sky.

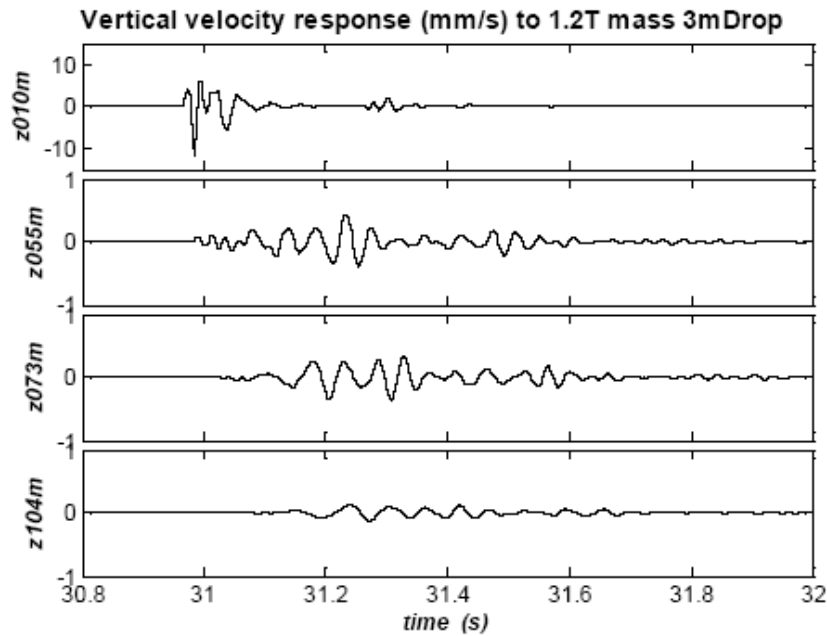
**MANY thanks
for your attention**

Common experiment on vibrations with technical service, beamlines and ASD in Feb08 to prepare the call for tender for the building extension.



Four groups of measurement instruments:

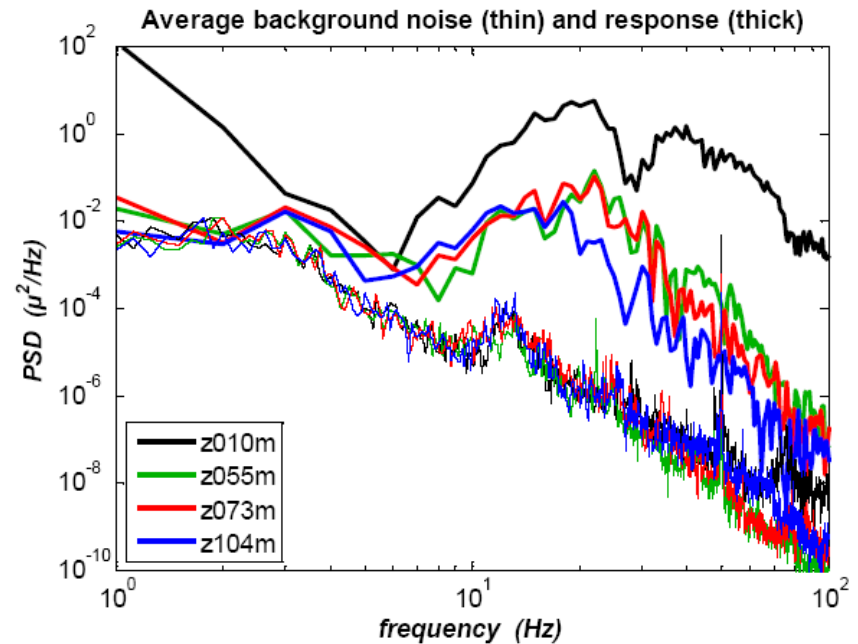
- Sensors around SRTU
- Sensors in an arrow from impact
- Sensors in ID24
- Electrons and X BPMs in ID24



Vibration attenuation with distance and time

Vertical vibration velocity response to the 1200 kg steel mass drop from 3 m height.

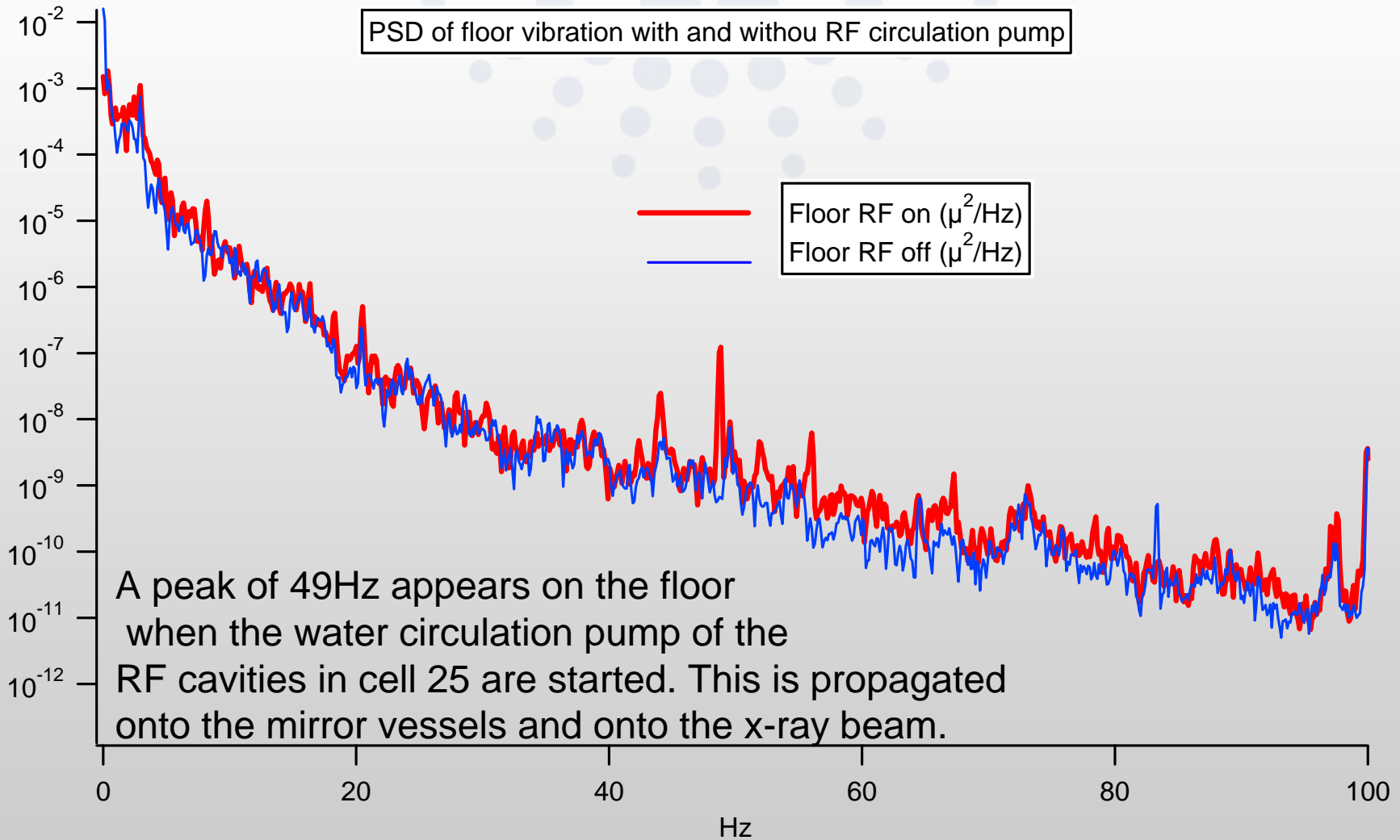
Measurement points are at 10, 55, 73 and 104 meters from the impact point.



Vibration attenuation with distance : spectral analysis

Vertical displacement PSD of the mass drop responses (thick lines) compared with the PSD of the background vibration noise (thin lines).

Data under processing



THE PTS SYSTEM FOR STAFFING SHIFTS

In 2007:

720 USM and USM-like shifts were covered by 81 PTS.

Since the start of the PTS system, on average 80 staff members participate every year in the continuous functioning of the installation as second member of the shift crew. The "typical" PTS is either a technician or engineer working in the Accelerator and Source Division, Technical or Computing Services.

Three members of the Administrative staff have joined the PTS pool and now participate on a regular basis.

CTRM activity (shift, standby, intervention) is represented on the group planning in the same way as other activities (absences, RTT, training, missions).

PLANNING ■ My group planning

From 21/01 To 03/02/2008 ▼ FORTNIGHT ▼

Name	Mon. 21/01	Tue. 22/01	Wed. 23/01	Thu. 24/01	Fri. 25/01	Sat. 26/01	Sun. 27/01	Mon. 28/01	Tue. 29/01
CHAZOT GILLES	.	.	.	.	.	.	.	.	.
CHIAPPINELLI STEPHANE	WRK	WRK	.	.	.	.	WRK	WRK	WRK
GARNODON GILLES	WRK	.	.	WRK	WRK	WRK	WRK	.	WRK
HARDY LAURENT	SBY	SBY	SBY	SBY	SBY	SBY	SBY	.	.
HENRISSAT PHILIPPE	ABS	.	.	.	.	.	.	ABS	ABS
JODAR PIERRE	WRK	WRK	.	.	.	.	.	.	.
KHADROUCHE KI	Morning Shift Machine		.	.	.	.	.	.	.
LEDRAPPIER BERNARD	.	.	.	.	.	.	.	.	.
NICLAS CHARLES	WRK	WRK	WRK	WRK	.	.	.	.	.
PAULIN MAXIME	.	.	.	.	WRK	WRK	WRK	WRK	.
ROUSSELY PHILIPPE	.	.	.	.	.	.	.	.	.

A dramatic photograph of a lightning bolt striking a building. The lightning bolt is a bright, jagged white and yellow streak descending from a dark, stormy sky. It strikes the roof of a long, low building with a white cylindrical tower. In the foreground, a parking lot contains several cars, including a silver sedan and a dark SUV. The background shows a range of mountains under a heavy, grey sky.

**MANY thanks
for your attention**