

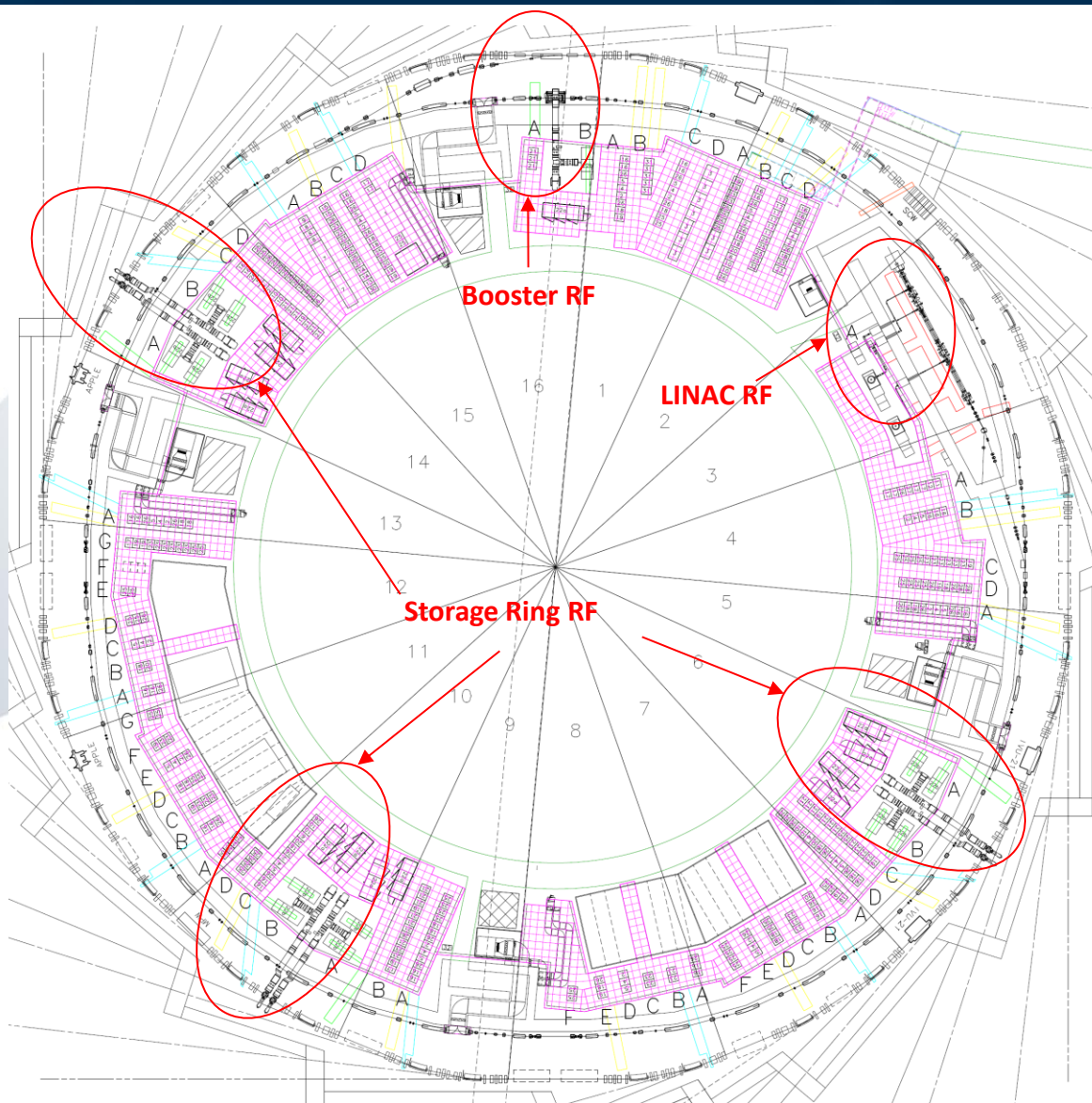
RF Status of ALBA

ESLS RF Meeting – Delta/Dortmund – Sept 2014

Angela Salom on behalf of RF team:
Francis Perez, Bea Bravo and Jesus Ocampo

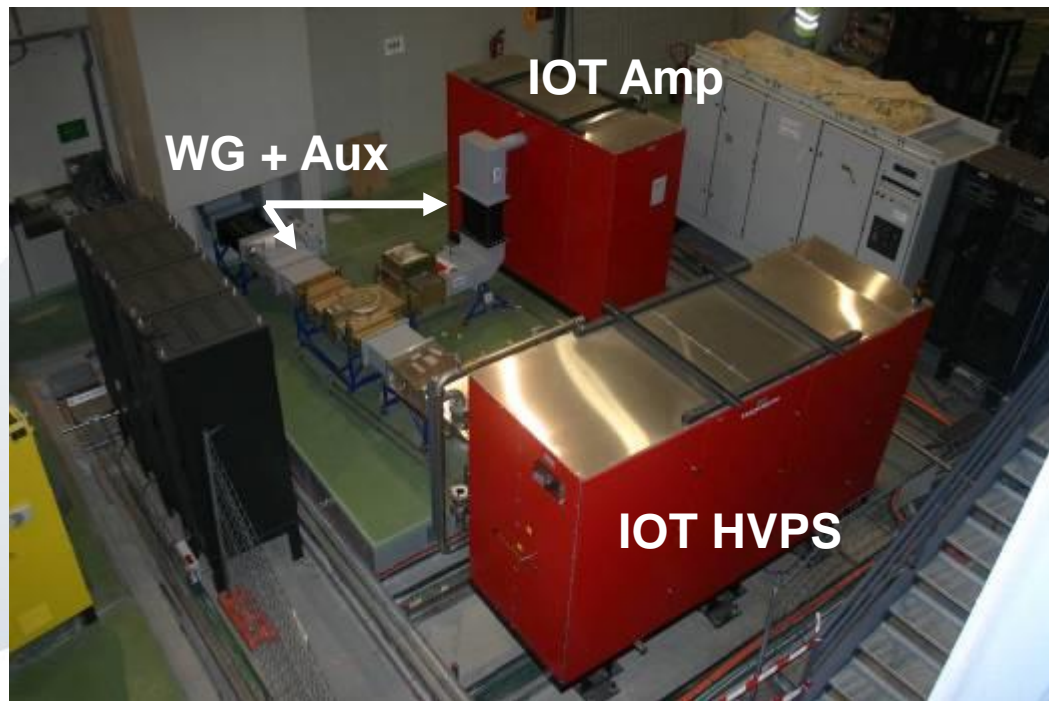
- ✓ ALBA RF Overview: Booster and SR
- ✓ Main ALBA Upgrades
- ✓ RF Operation with beam
 - Statistics of RF operation
 - IOTs Status
 - RF Incidents
- ✓ RF Upgrades:
 - Feedforward loops
 - RF lab
- ✓ Future RF Upgrades:
 - New IOT tubes from L3
 - Active 3rd Harmonic Cavity

- Linac
 - 2 Klystrons + WG system + travelling wave cavities at 3GHz
 - 90keV to 100MeV
- Booster
 - IOT + WG System + 5-cell cavity @ 500MHz
 - 100MeV to 3GeV
- SR
 - 12 IOTs + WG system + 6 cavities @ 500MHz
 - Beam stored @ 3GeV





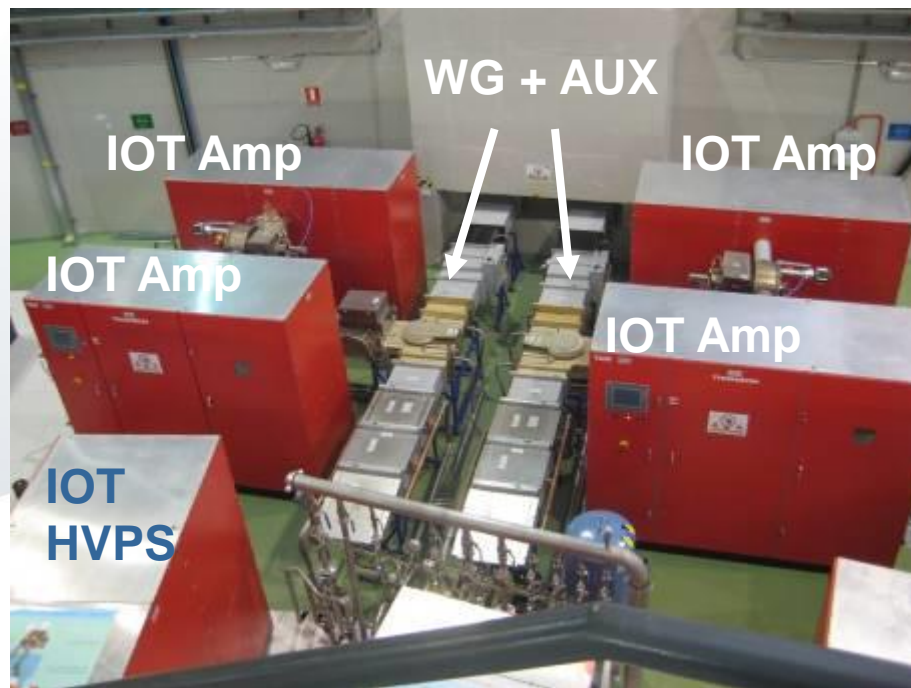
**Tunnel:
5Cell Cavity – 500MHz**



Service Area: RF amplifier + Auxiliaries



**Tunnel: Dampy Cavities
1Cell – 500MHz**

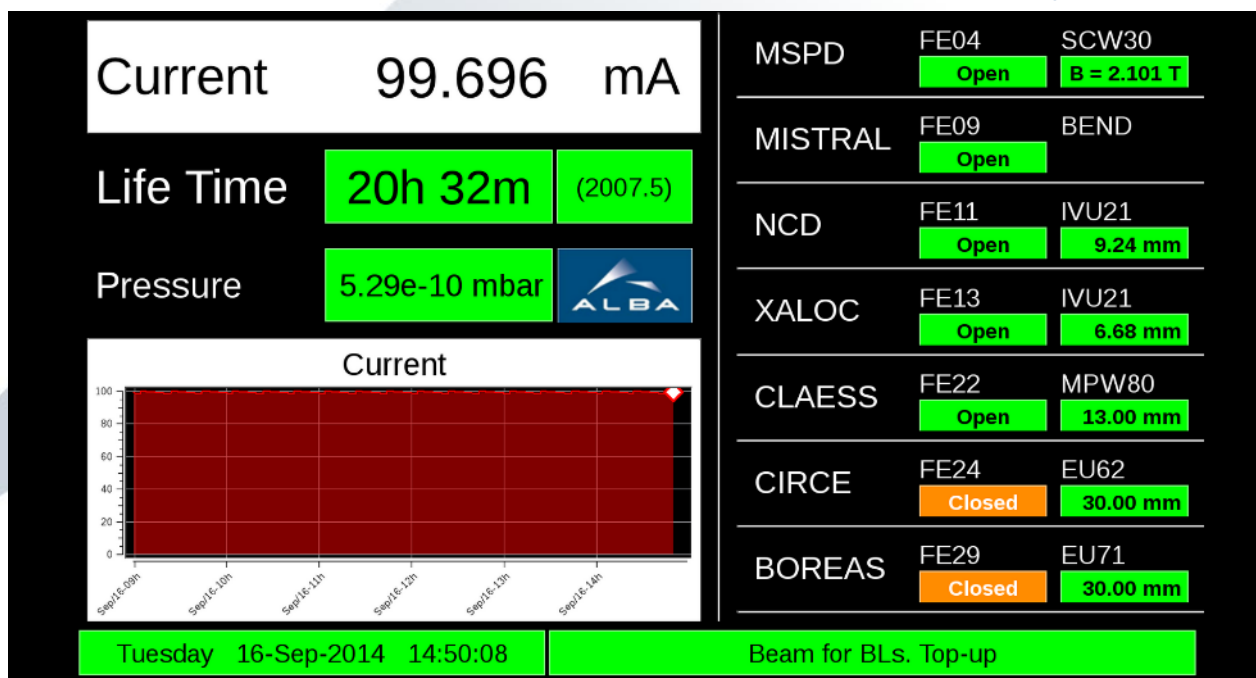


**Service Area: RF amplifier +
Auxiliaries**

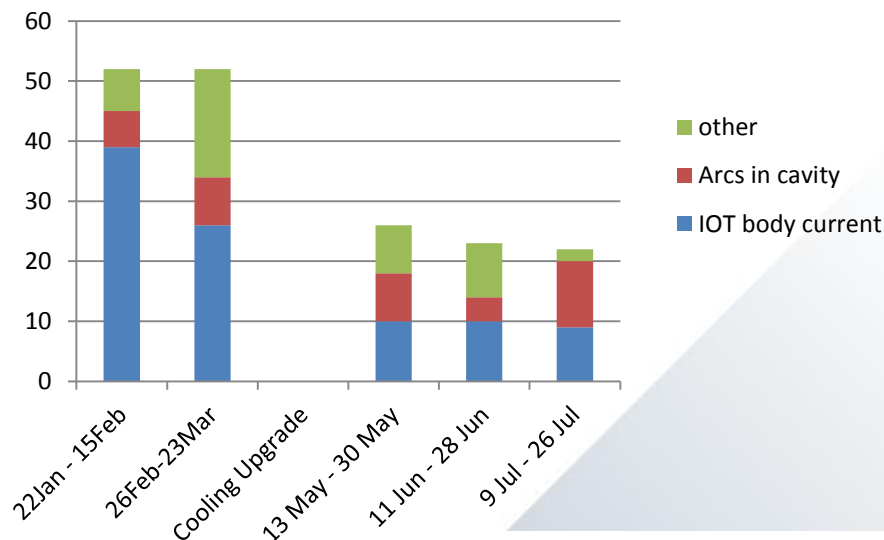
✓ Cooling Upgrade

- More diagnostics: pressure and water flow meters
- Alarms management
- Air releasers
- Filters in main manifolds and Power Supplies

✓ Fast Orbit Feedback and Top-up since July 2014

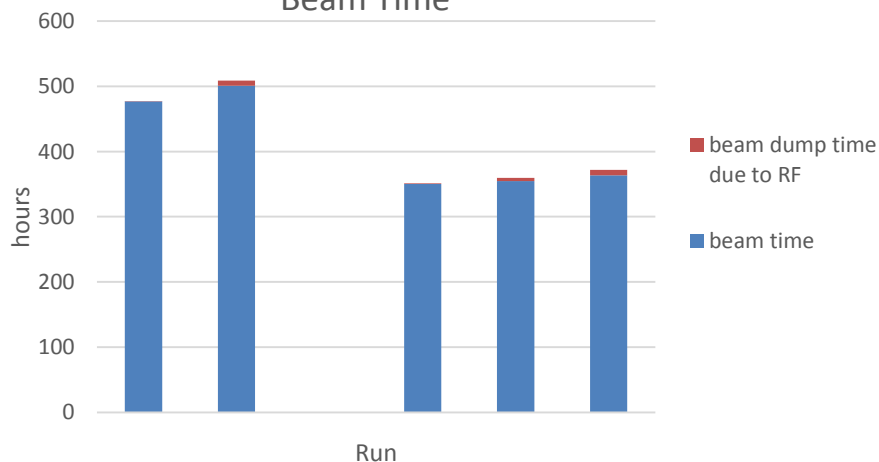


RF Interlocks per run



- ✓ Main improvement from last year: no water cooling interlocks
- ✓ Not all interlocks produced beam loss
- ✓ Number of interlocks decreasing
- ✓ Main drawback: number of beam losses due to RF ITCKs increasing

Beam Time



Run #	RF Failures producing beam dump (%)	Total beam hours	Downtime due to RF failures (h)
1	3.8%	476.8	0.6
2	15.4%	500.7	8
3	11.54%	350	1
4	39.13%	354.8	4.5
5	54.54%	363.4	8.3

✓ Last runs working with 10 IOTs

✓ **6 IOTs got broken during last 12 months (3 of them brand new)**

SN	SAT Date	Date Broken	FIL Hours	HV Hours	Comments
617551	30/07/2010	18/06/2014	16622	12006	broken after body current in tx03
620408	17/09/2010	12/02/2014	18257	13250	Broken after several consecutive body currents
634238	23/09/2011	19/07/2014	18979	15713	Broken after body current at 45kW
723734	25/10/2013	29/10/2013	--	--	IOT broken due to wrong manufacturing process of the ceramic. Reimbursed by Thales
747014	01/08/2013	20/08/2013	--	--	Vacuum seal not good. Returned to Thales
761523	27/04/2014	12/07/2014	1694	1482	Broken after body current working at 60kW CW – to be reimbursed by Thales

✓ **Overall broken IOTs since 2010: 16**

- IOT average life: FIL ~ 7950h, HV ~ 5800h
- IOT average life disregarding infant mortality: FIL ~ 12000h, HV ~ 8800h

✓ 11 Active IOTs in SR

- IOT average: FIL ~ 10125h, HV ~ 7700h
- IOT average power: 30kW at 100mA

you are here: home → intranet → mis applications → cman

CELLS Maintenances Tool

Summary IOTs Transmitters Logs Reports

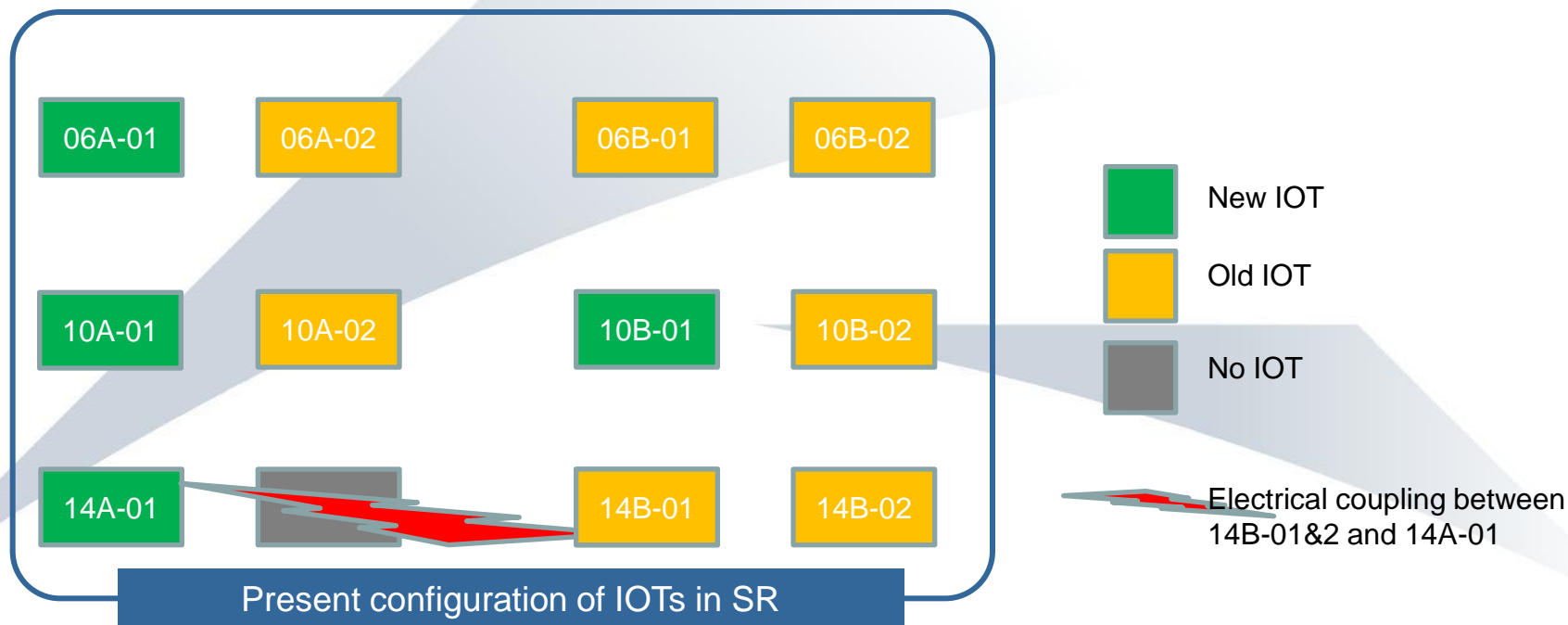
IOTs running at 10kW max to avoid body current ITCKs

Summary

IOT Name	Last TX	Serial number	Status	Total HV hours	Total filament hours	HV > 150hrs.	HV > 2000hrs.
ALBA_IOT_002	TX14	499443	Active	16771.00	23218.00	i	!
ALBA_IOT_008	TX08	617302	Active	16473.00	21344.00	i	!
ALBA_IOT_009	TX13	617549	Active	16185.00	21373.00	i	!
ALBA_IOT_012	TX05	623096	Active	13536.00	20278.00	i	!
ALBA_IOT_021	TX06	720105	Active	9921.00	11938.00	i	!
ALBA_IOT_022	TX10	731330	Active	7995.00	9600.00	i	!
ALBA_IOT_026	TX04	747211	Active	6001.00	7051.00	i	!
ALBA_IOT_027	TX11	758883	Active	2809.00	3078.00	i	!
ALBA_IOT_029	TX02	760354	Active	1379.00	1619.00	i	!
ALBA_IOT_028	TX03	759044	Active	716.00	744.00	i	!
ALBA_IOT_031	TX09	762037	Active	528.00	642.00	i	!
ALBA_IOT_032	TX07	766836	Active	463.00	617.00	i	!
				92777.00	121502.00		

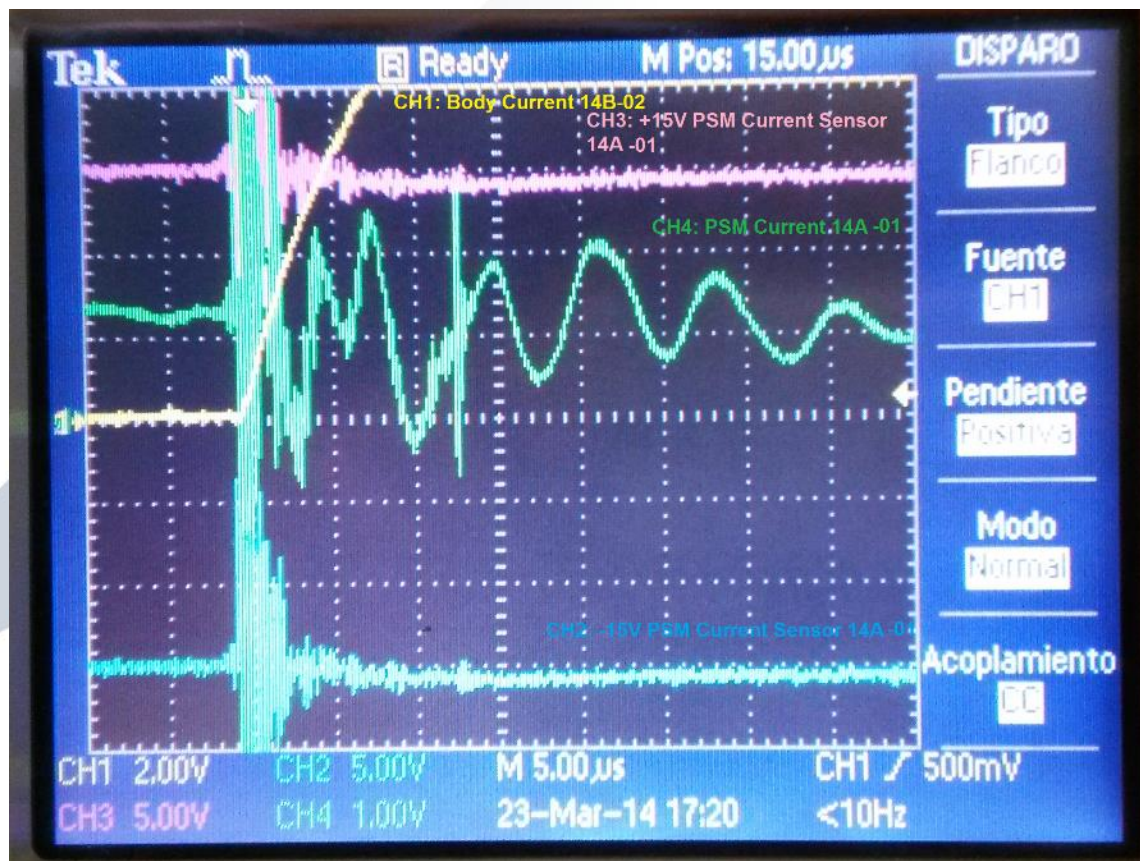
✓ Electrical coupling between IOTs of Sector 14:

- When body current in IOTs 14B-01 or 14B-02, noise induced in current sensor of HVPS of IOT 14A-01
- Ferrites added to sensor
- EMI Filters installed
- Grounding improvements



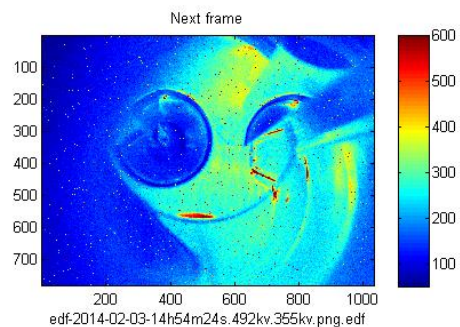
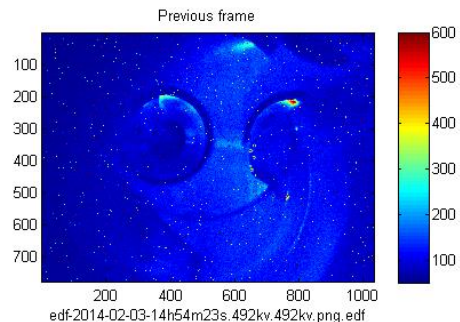
✓ Electrical coupling between IOTs of Sector 14:

- Scope connected to current sensor of 14A-01 and trigger by body current of 14B-01



✓ In Easter 2013 absorber of sector 06 replaced

- Arcs in cavity 06B when voltage > 350kV for a year already
- Several conditioning process, but problem persists
- CCD camera installed in cavity view port to “catch” arcs. Not easy since there is always light due to coherent second emission



Info provided by A. Nosych & U. Iriso

✓ **Predrivers: SSA**

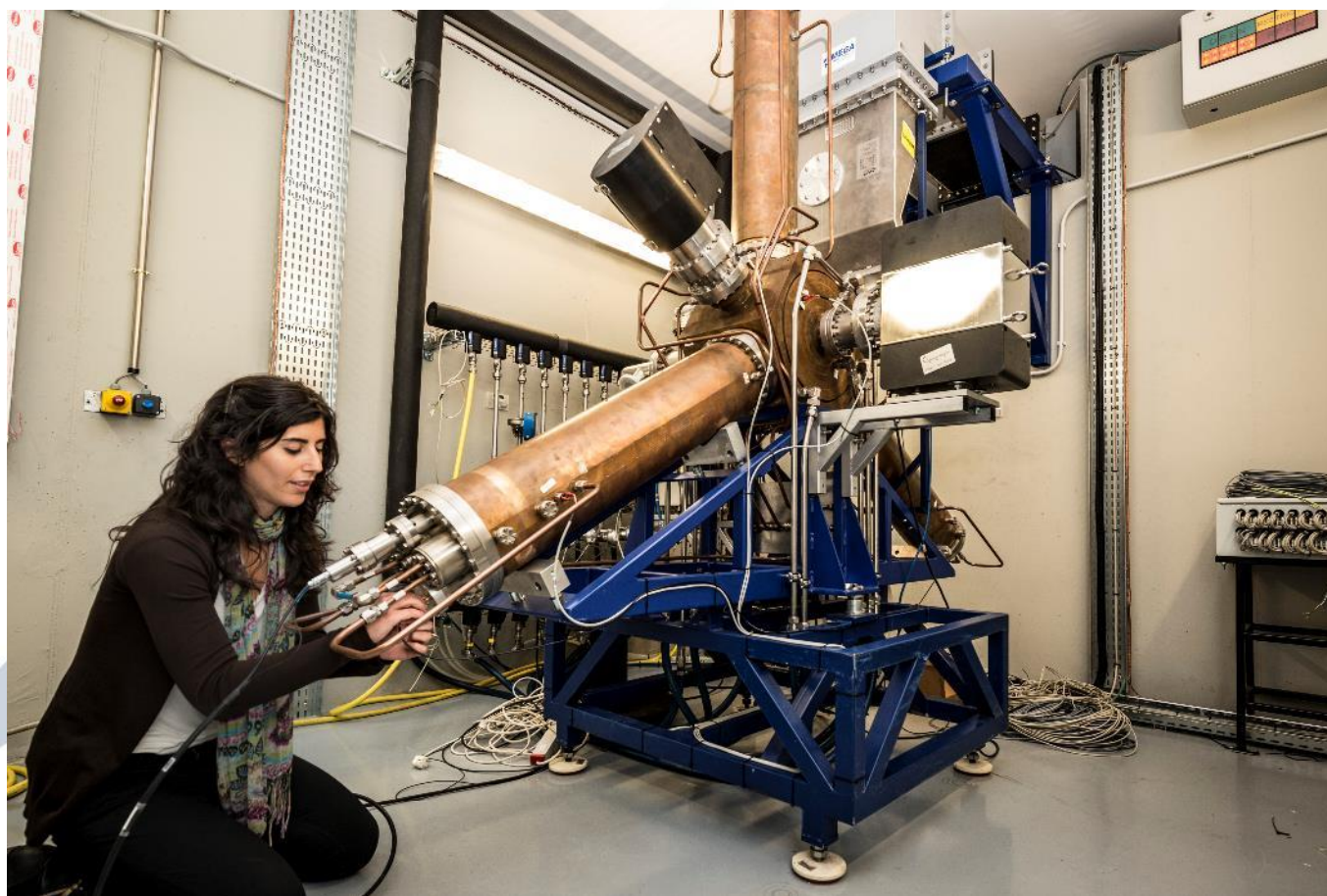
- Thermal phase drift
- Gain jumps
- More diagnostics added to SSA output to be able to detect problems faster

✓ **Circulators coils short-circuit**

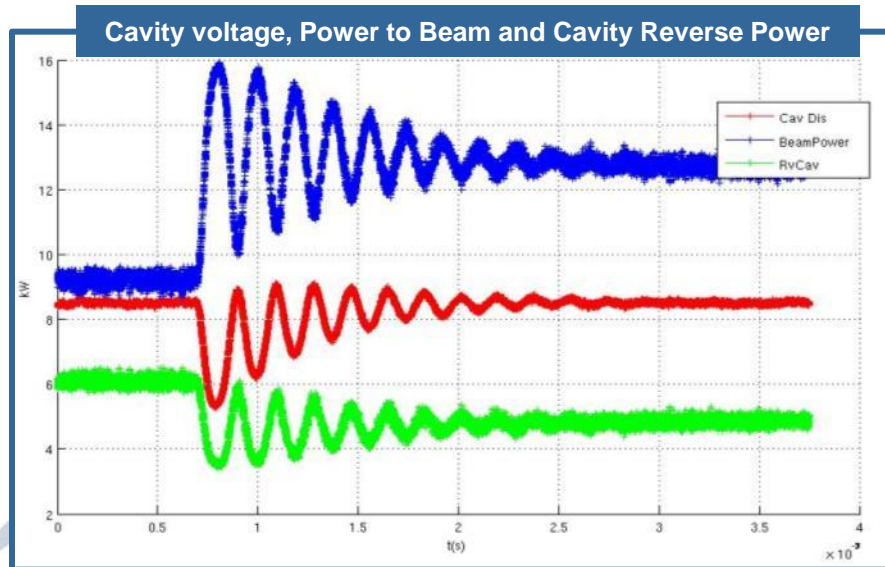
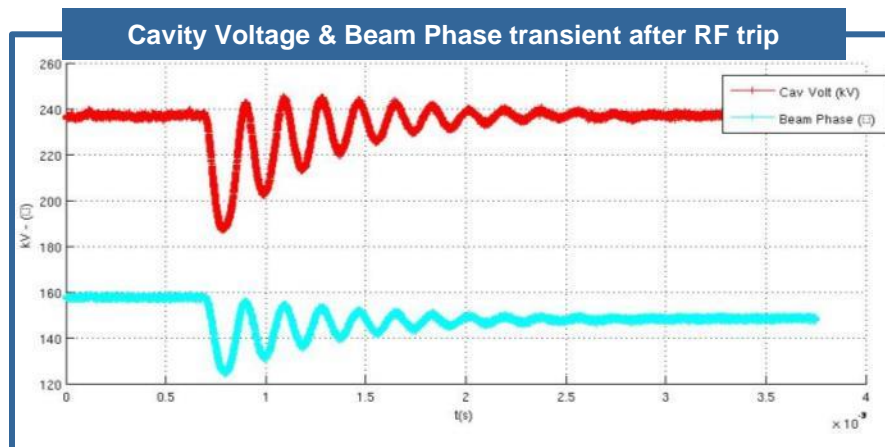
- Capton added between coils and circulator body

High Power RF lab in operation since 2014

- ✓ To be used for IOTs and Cavities conditioning and general RF equipment tests
- ✓ Agreement signed with CIEMAT lab for conditioning of Cavities for other accelerators



Feedforward loop to compensate transient when RF cavity trips



✓ When cavity trips

- Cavity Voltage oscillates with frequency equal to synchrotron tune
- Transient time equal to damping time of machine

✓ Compensation

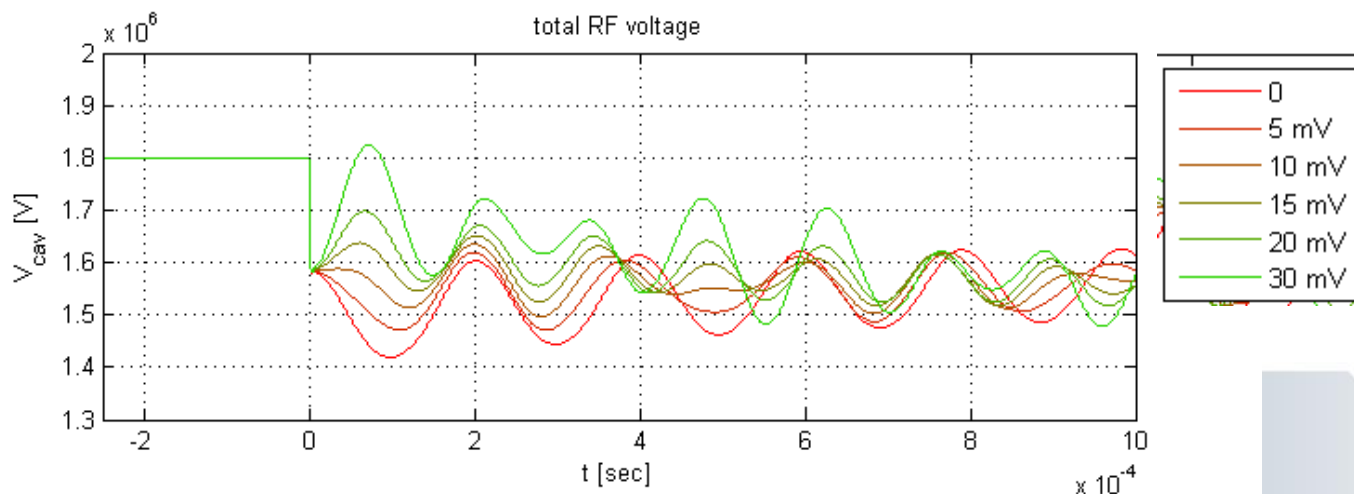
- Amplitude modulation triggered when one cavity trips
- Frequency, amplitude and phase of modulation are adjustable parameters

✓ Tests with beam:

- Adjustment of frequency very critical
- First ripple of perturbation reduced but following ones increased

Simulations run by Jordi Marcos to optimize parameters of compensation

- Overall voltage 1.8MV and 0.2MV suddenly lost (cavity trip)
- With an active compensation equal to 10% of the lost voltage ripples get reduced



Evolution of Overall RF Voltage after cavity trip depending on amplitude of applied compensation

✓ New tubes from L3:

- Contract signed in June 2014
- First prototype to be tested in RF lab in January 2015
- 4 IOTs to be installed in SR in August 2015

✓ Third Harmonic Cavity

- CLIC Collaboration to develop 1.5GHz RF system between CELLS and CERN
- To be used as an RF accelerator system in CLIC
- To be used as third harmonic cavity in CELLS
- Further details in B. Bravo presentation

Summary & Conclusions

- ✓ IOTs body current interlocks still main source of problems of RF
- ✓ With new RF lab bad IOTs will be long term conditioned. We have observed better behavior after high-potting and conditioning
- ✓ Expected better statistics with new IOTs
- ✓ Still adding improvements to RF systems

Acknowledgments

- ✓ RF team: Francis Perez, Bea Bravo, Jesus Ocampo and Pol Solans.
- ✓ Diagnostics and IDs: Andriy Nosich, Ubaldo Iriso and Jordi Marcos
- ✓ Operators, technicians and controls support

Thanks for your attention