

Status and Operation of the ALBA RF System

Jesús Ocampo, on behalf of the ALBA RF group:

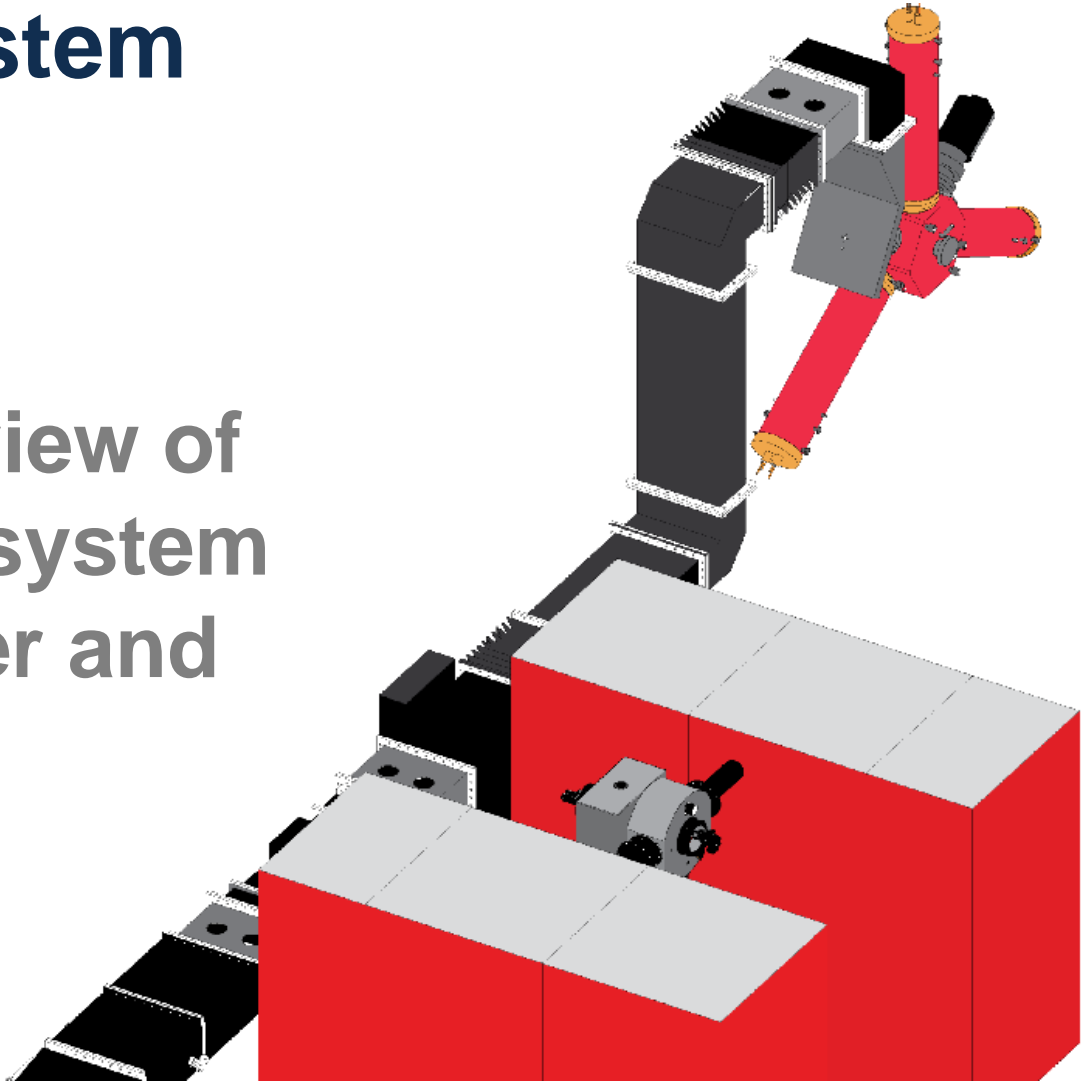
F. Pérez, A. Salom, B. Bravo, P. Solans, J. Álvarez, Z. Hazami, R. Fos



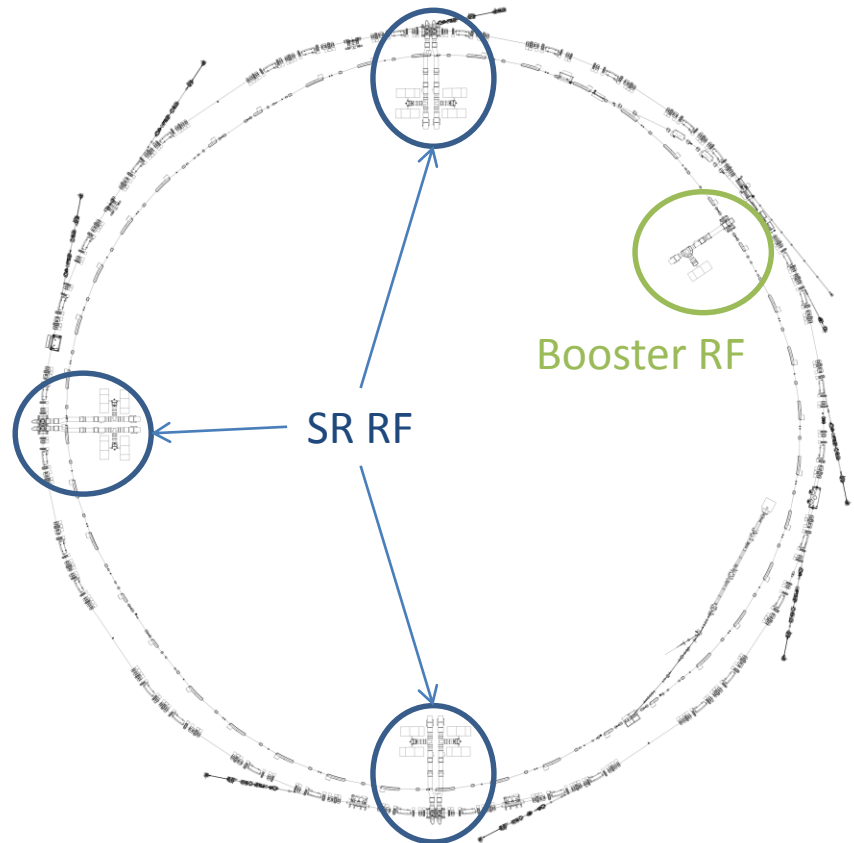
1. Overview of the ALBA RF system
2. ALBA RF operation
3. IOT's
4. New developments
5. Conclusions

ALBA RF system

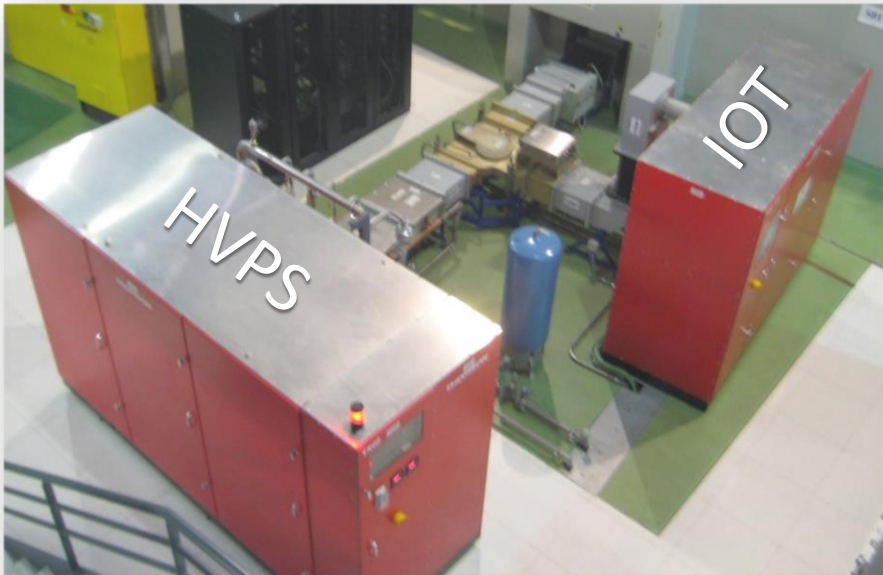
General overview of
the ALBA RF system
for the Booster and
Storage Ring



- **Booster:**
 - 100MeV to 3GeV
 - 5 cell PETRA cavity
 - 80kW IOT
- **Storage ring**
 - 200mA top-up operation
 - 6 DAMPY cavities
 - 12x80kW IOT



Service area:
80kW IOT amplifier

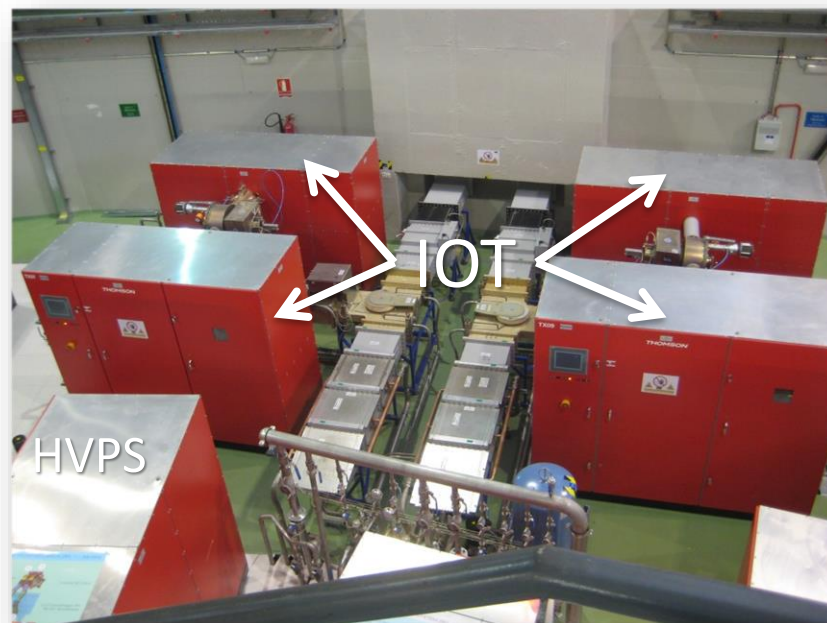


Tunnel:
5 Cell PETRA Cavity 500MHz



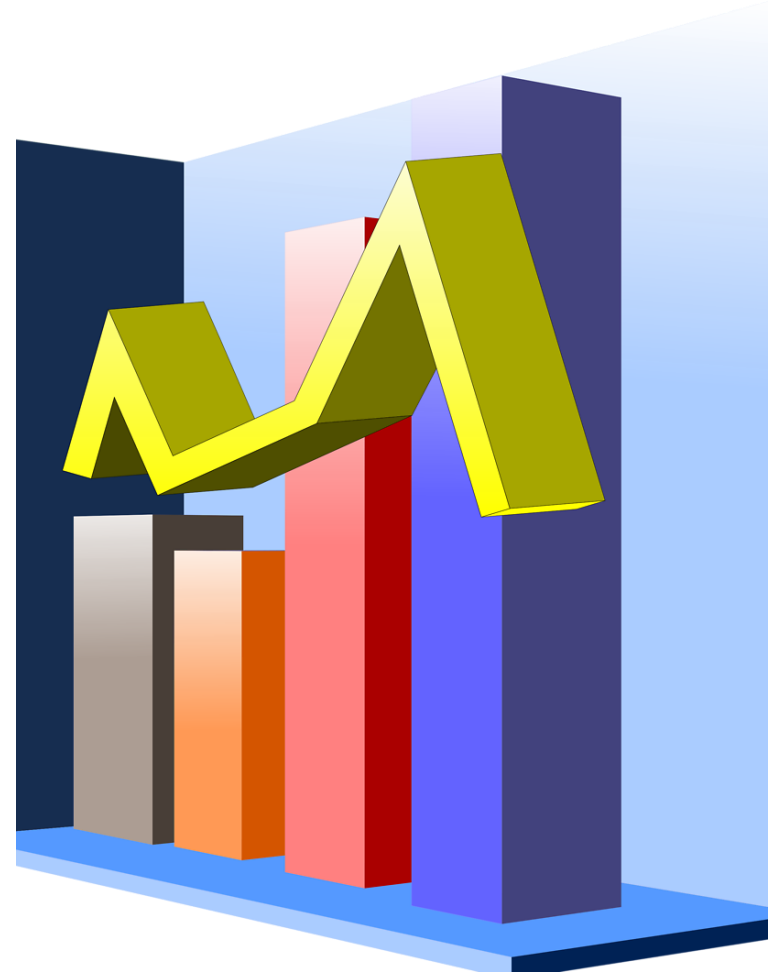
Tunnel: Dampy cavities
single cell – 500MHz

Service area:
2 80kW IOT amplifiers/cavity



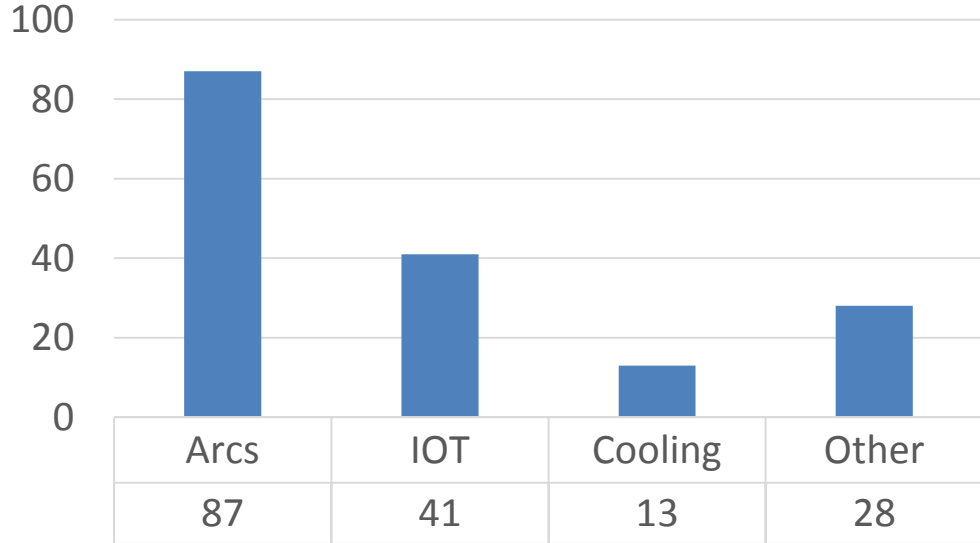
ALBA RF operation

Statistics of 2017
Evolution since 2013
Operation incidences



Operation mode: Top-up 150mA → 200mA (since October)
 450kV/cavity → 500kV/cavity

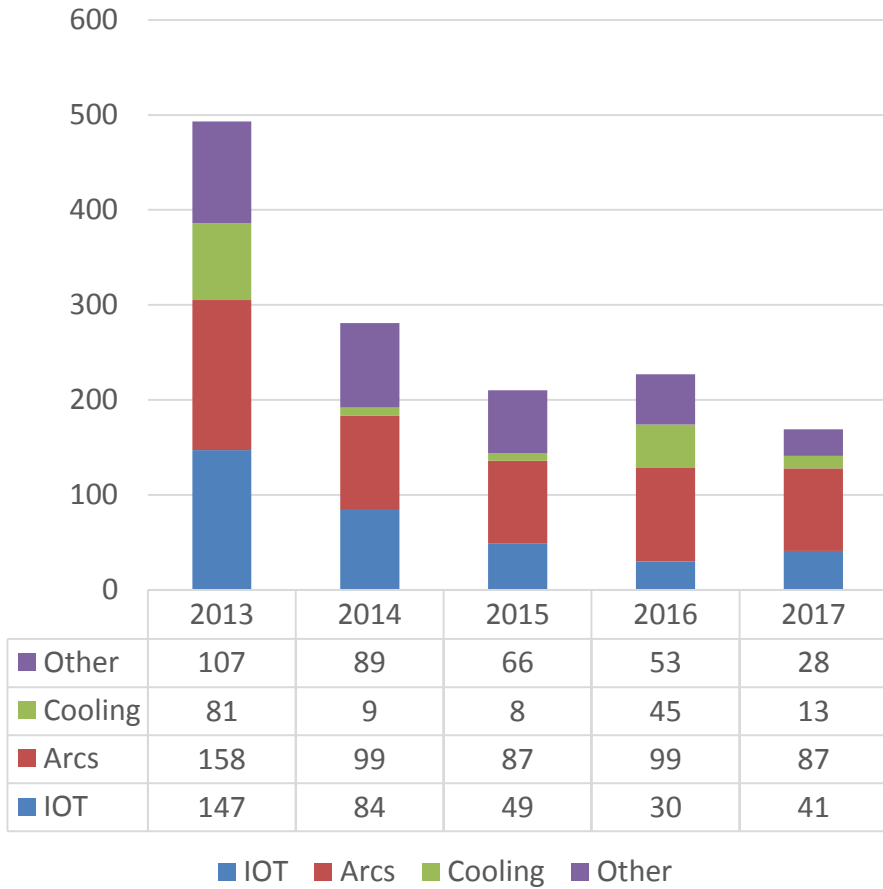
2017 RF interlocks



Total: 169 interlocks
 Only 13 beam losses (7,7%)
 8,3 hours downtime (0,2%)

75% of cavity arcs after increasing voltatge from 450kV to 500kV
 75% of IOT interlocks in newly installed L3 IOT's. They disapear in ~ 2 months

RF interlocks



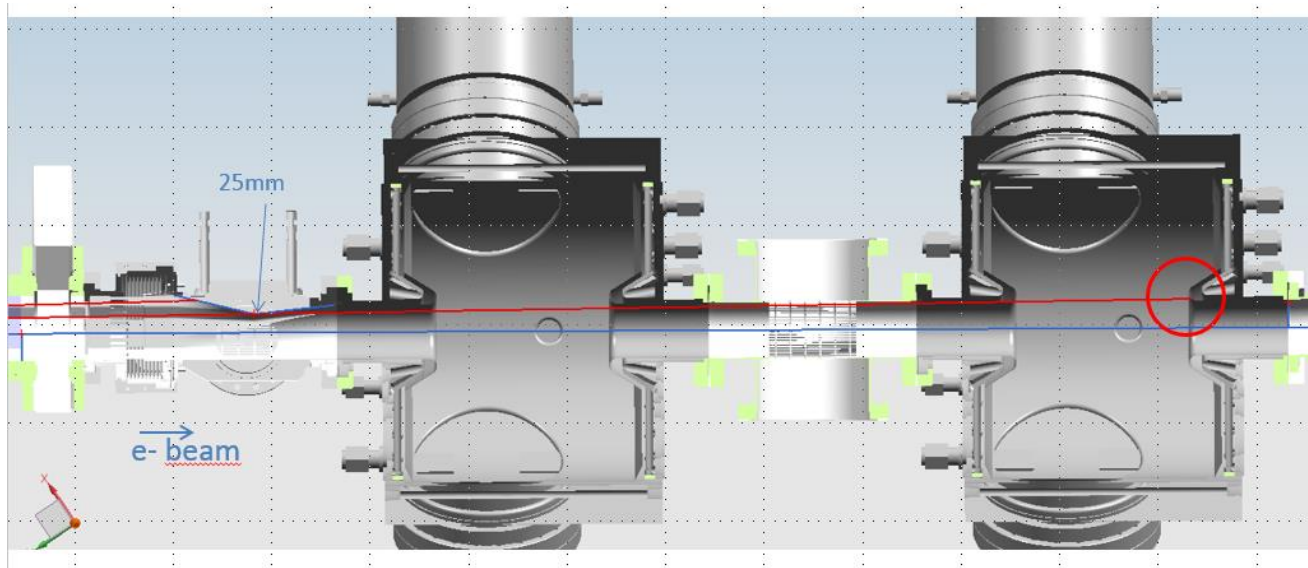
Cooling interlocks greatly reduced

IOT interlocks similar to last year, even though 6 new IOT's have been installed

Arc interlocks similar to last year, despite the voltage and beam current increase

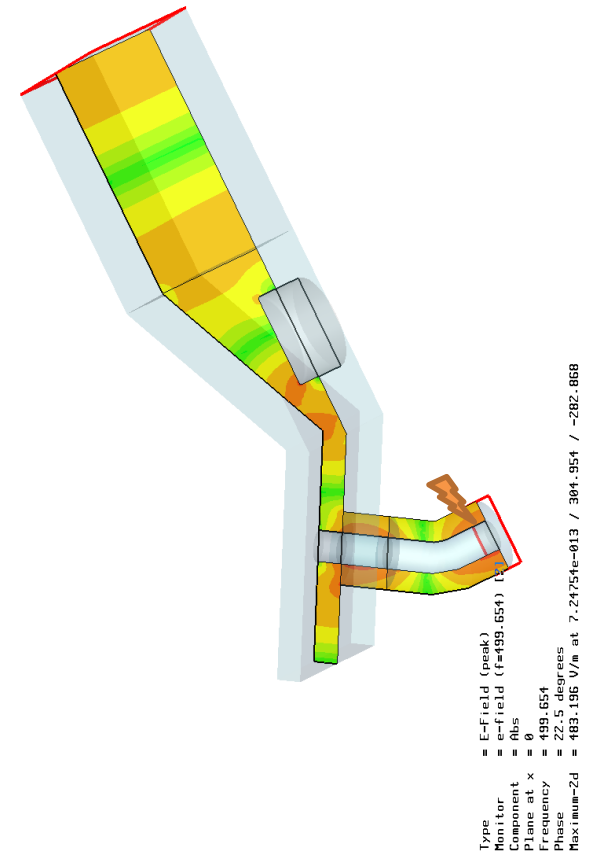
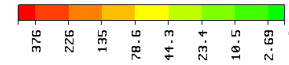
06B cavity arching solved

- Cavity opened in January 2016
 - Marks of synchrotron radiation impact in the nose cone
 - Ray tracing shows the origin: radiation from the previous bending magnet not blocked by the absorber
- Absorber replaced
 - Interlock number now on par to other cavities

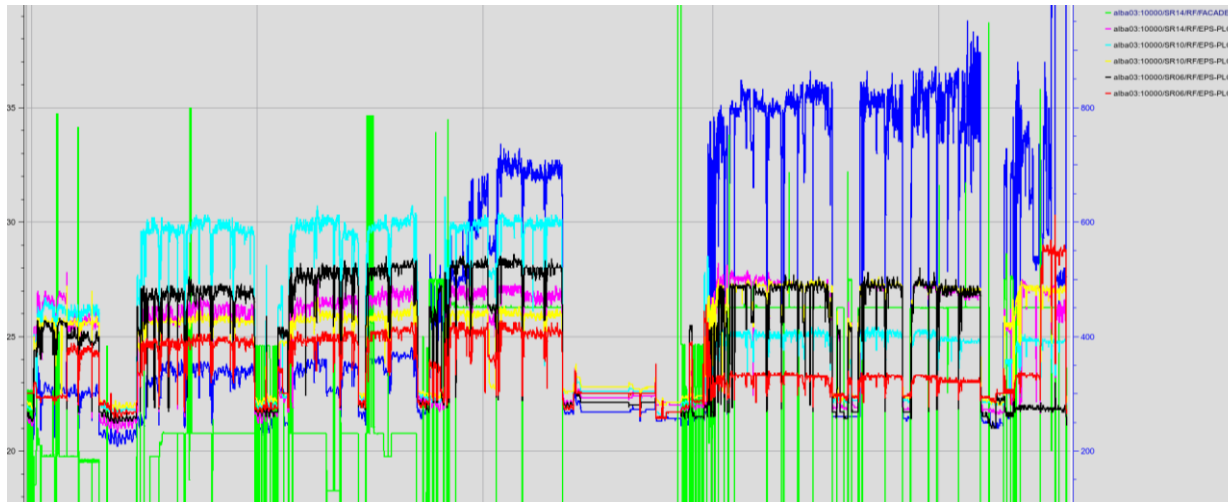


Ray tracing courtesy of R. Monge (Vacuum group)

- 6 arcs during one night
- Coaxial WG Circ Clip damaged

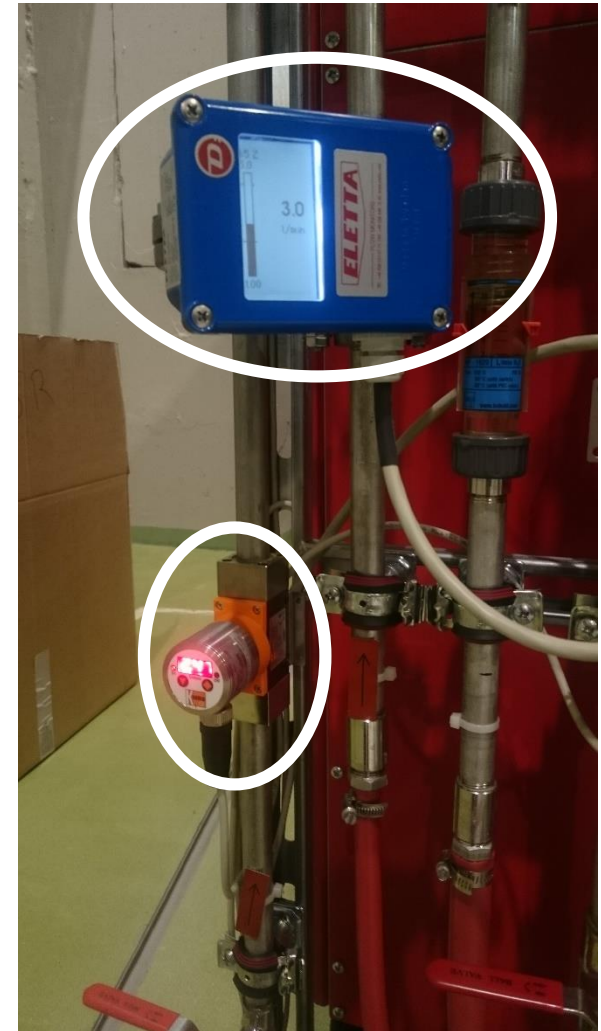


- New coaxial WG made by Rymosa and currently in operation
- Later analysis
 - Cooling air temperature of coaxial part (blue) increased from 25° to 35° in the last months



Cooling interlocks

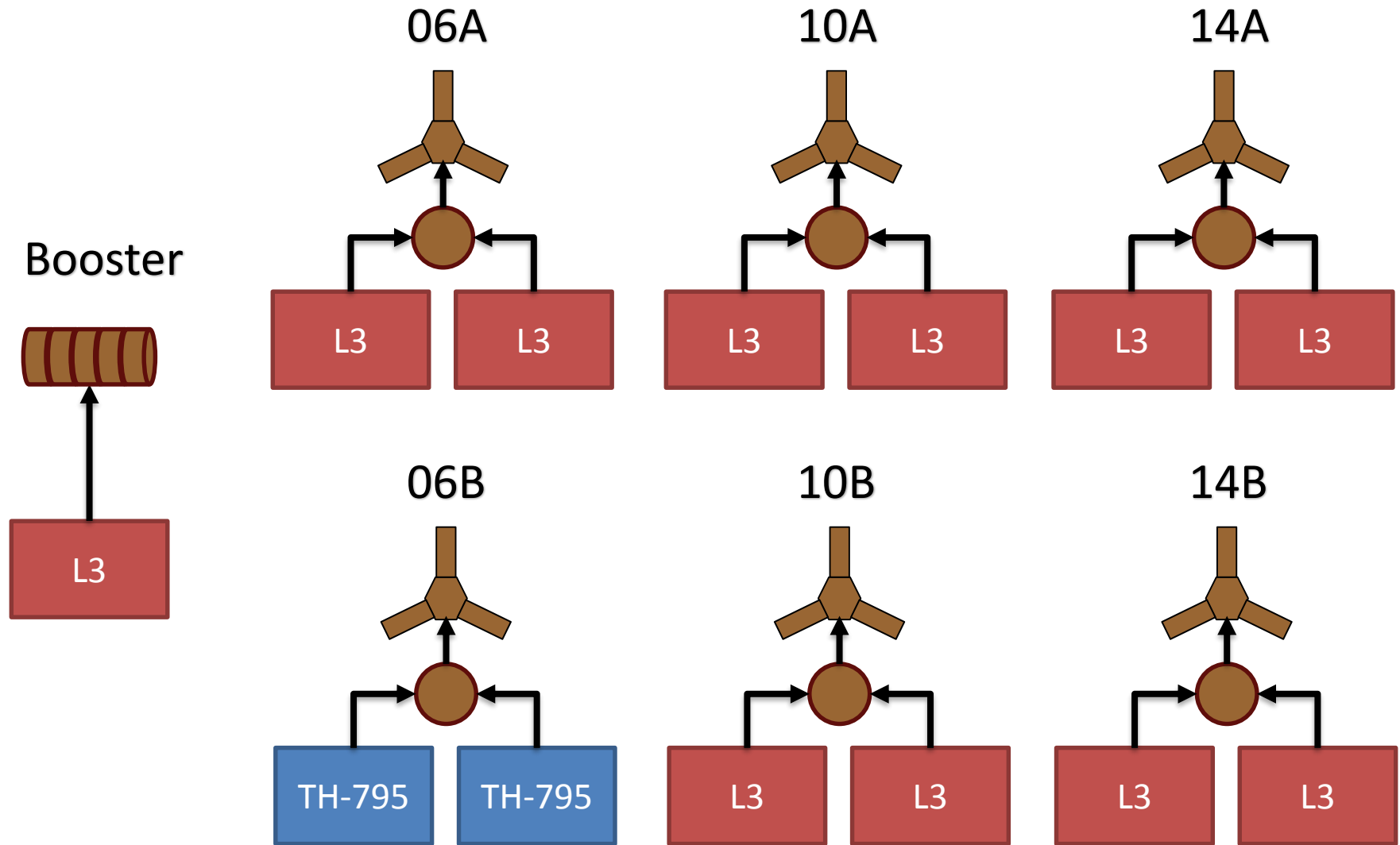
- Fake cooling interlocks
 - Old WFM's sampling rate of 0,5s
 - Some samples are lost internally
 - A delay of 1s was not enough to prevent all fake interlocks
- New WFM no incidences so far
- Gradual replacement.



IOT's

Current configuration
New TH-795
L3 L4444-C
TH-794 reconditioning
Stock and hours





What's new?

- Ceramic and gun: more reliable
- Adaptation kit needed
- +1MHz bandwidth tuning required, but gain is not compromised

Flawless operation in ALBA

- Total of 3 arcs in 1,5 years
- 9249 and 7375 FIL hours

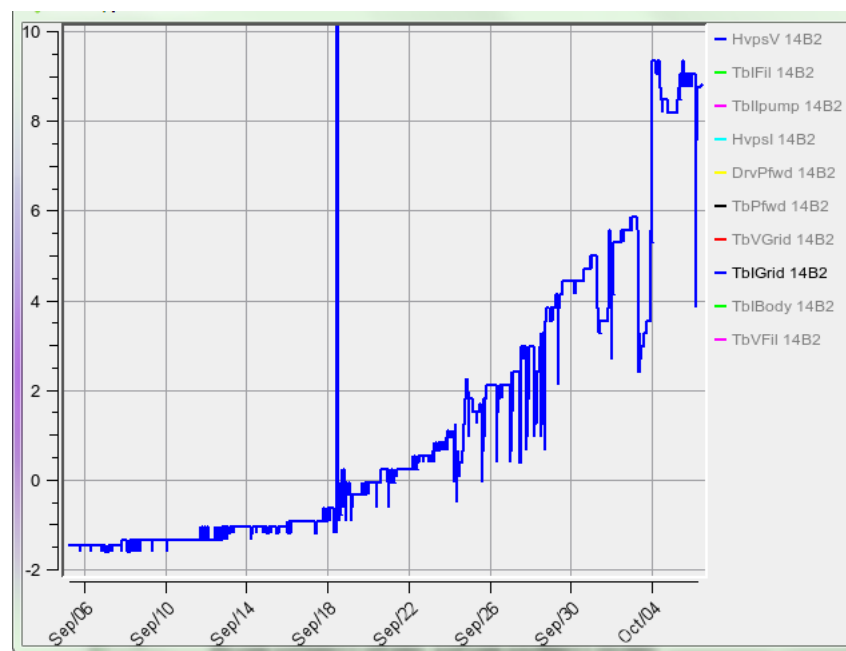


TH795 with upper adaptation ring installed



Lower ring of the adaptation kit

- 13 units received and successfully tested
- Modifications done to the first series made the operation more reliable
- Manage heater carefully to prevent grid emission



Grid emission in 100017 during first month

- 7 units > 15.000 hours
- We need all IOTs to work at 60kW
- Gun cleaning process
 - High-potting
 - Grid scrubbing
- Increase bandwidth +1MHz to reduce field in output window
- 2 output windows broken at 45kW

TX	SN	Type	HV hrs	FIL hrs
TX01	100020	L4444-C	0	0
TX02	100005	L4444-C	17182	18480
TX03	100009	L4444-C	14148	15359
TX04	100007	L4444-C	13219	14347
TX05	830864	TH-795	8847	9249
TX06	778208	TH-795	7096	7375
TX07	100013	L4444-C	3560	3774
TX08	100014	L4444-C	3557	3764
TX09	100015	L4444-C	2908	3095
TX10	100016	L4444-C	2911	3055
TX11	100008	L4444-C	13373	14641
TX12	100006	L4444-C	14148	15493
TX13	100017	L4444-C	1511	1596
TX14	100018	L4444-C	1540	1637

SN	Type	Status	HV hrs	FILhrs
100019	L4444-C	Spare	21	26
844118	TH-795	Spare	2303	2426
1634010	TH-794	Spare	14906	16318
771181	TH-794	Spare	15756	17364
762037	TH-794	Spare	18719	20755
747211	TH-794	Spare	25678	28521
731330	TH-794	Spare	27429	31082
623099	TH-794	Not reliable	13060	19001
499443	TH-794	Not reliable	23765	31442

SN	Type	HV hrs	FILhrs	How broken?
610736	TH-794	25	200	Operation
499413	TH-794	840	1297	Operation
761523	TH-794	1482	1694	Operation
720785	TH-794	1088	1714	Operation
623097	TH-794	515	2316	Operation
610737	TH-794	3324	4221	Operation
629734	TH-794	5080	7828	Operation
723734	TH-794	6501	8203	Operation
758883	TH-794	7977	8977	Operation
760354	TH-794	8273	9496	Operation
766836	TH-794	8643	9833	Operation
617550	TH-794	6970	10296	Operation
608802	TH-794	7585	10627	Operation
623098	TH-794	12004	15456	Operation
759044	TH-794	15749	17517	Operation
617551	TH-794	13637	18621	Operation
634238	TH-794	15713	18979	Operation
617302	TH-794	17377	22507	Operation

18 broken in operation

SN	Type	HV hrs	FILhrs	How broken?
720105	TH-794	13907	16661	High power test
617549	TH-794	25384	31910	High power test
611024	TH-794	34	58	Human error
620408	TH-794	13250	18257	Human error
623096	TH-794	19651	25429	Human error
747014	TH-794	0	0	Defective
726543	TH-794	50	74	Defective
724075	TH-794	39	97	Defective
610735	TH-794	4851	7468	Trolley damage
591095	TH-794	106	150	TV type (not broken)

10 broken for other reasons

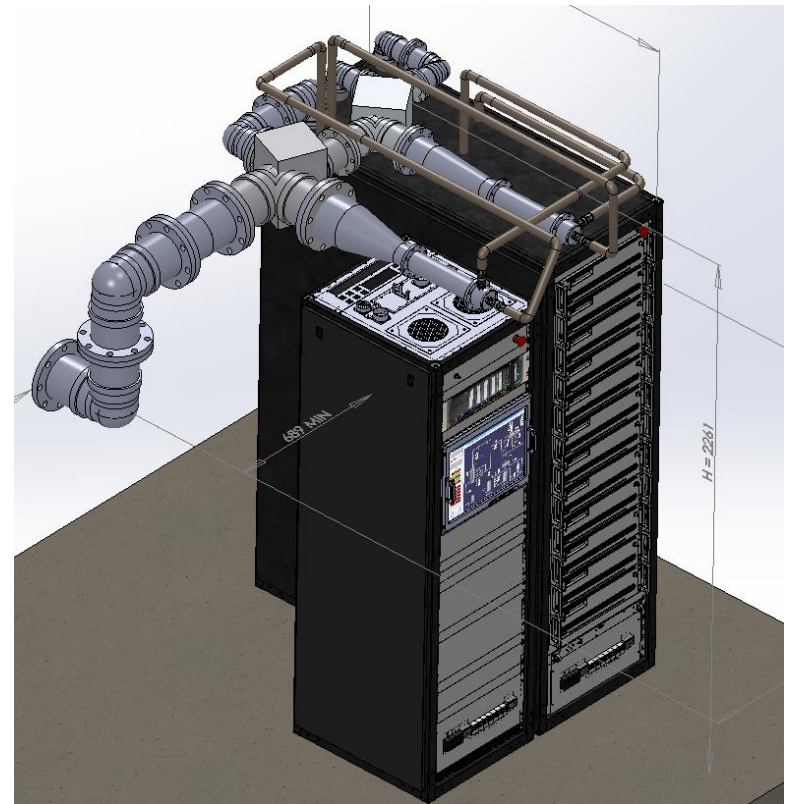


Upgrades and New developments

Booster 50kW SSA
3rd harmonic system



- Provide redundancy
 - Currently 1 80kW IOT
 - SSA will consist of 12 modules
- Contract awarded to BTESA
 - Design of the modules almost finished
 - Mechanical design ready
 - SAT August 2018



- Collaboration with CLIC to build a 1,5GHz RF system
 - Accelerating system in damping ring
 - 3rd harmonic system in ALBA
- Cavity design almost finished
 - See B.Bravo talk tomorrow
- 1,5GHz SSA module prototype
 - See Z. Hazami talk tomorrow

- RF operation
 - Increased voltage and beam current add stress to the cavities
 - New IOT's need 2 months to achieve stable operation
 - 1 or 2 interlocks per week, but most times the beam survives
- IOT's:
 - We can use the TH-795 or the L3 IOT for normal operation
 - We are trying to operate the old 794 at 60kW
- Improvements
 - Booster SSA should add redundancy to the injector

Status and Operation of the ALBA RF System

Thank you for your
attention.

