



ALBA Status

Montse Pont

On behalf of the Accelerator Division



Outline

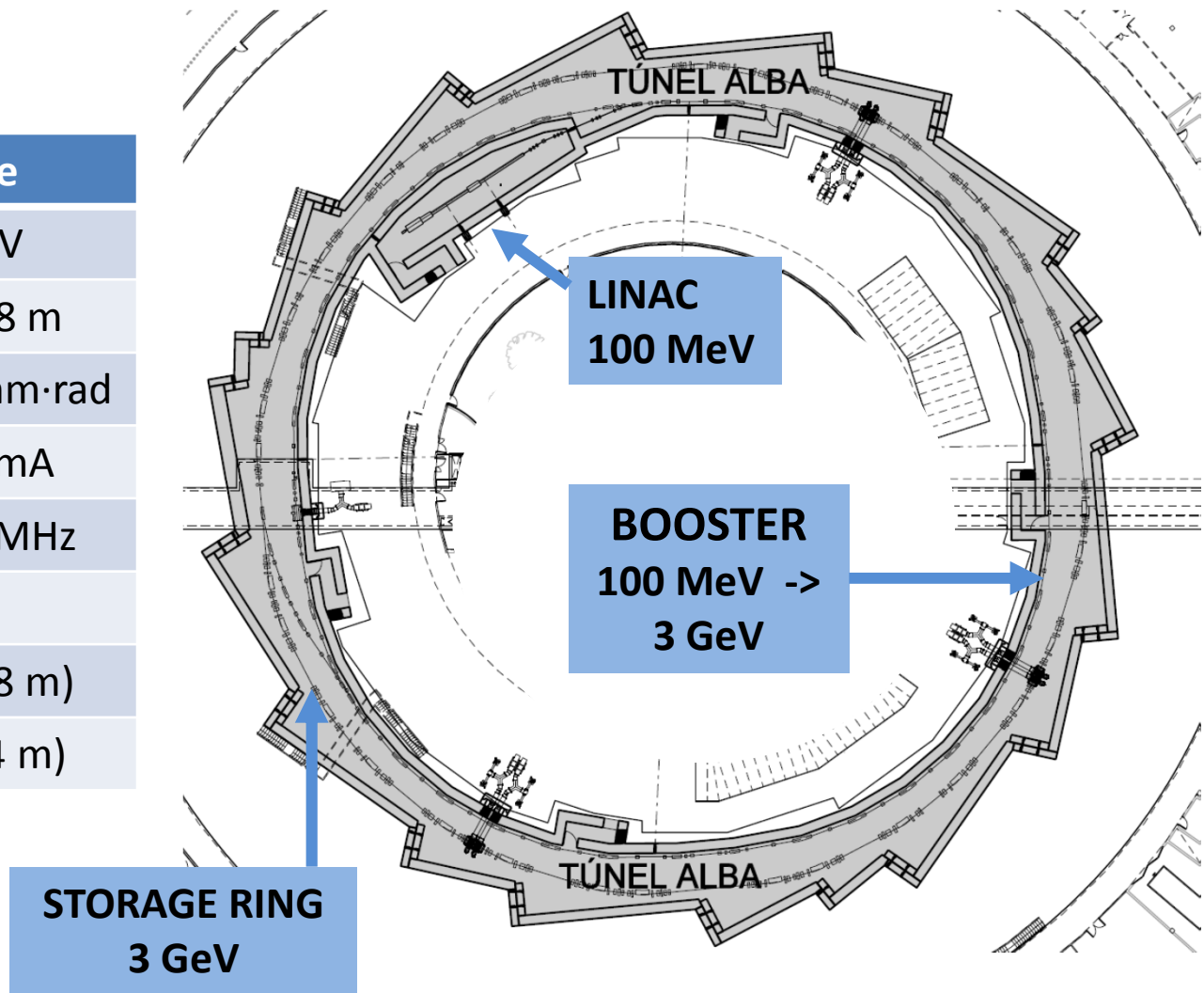
- Introduction
- Operation in 2017
- Accelerator Developments



Introduction

Accelerators

Parameter	Value
Energy	3 GeV
Circumference	268.8 m
Emittance	4.5 nm·rad
Current	250 mA
Rf frequency	500 MHz
# cavities	6
Long straights	4 (8 m)
Medium straights	12 (4 m)





BLS

In operation (8)

In construction (3)

BL29: BOREAS
EU71 - (0.08-3 keV)
REsonant Absorption
and Scattering

Bending: e⁻ Diagnostics

BL01: MIRAS
Bending - (0.4-100 μm)
IR Spectroscopy

BL24: CIRCE
EU62 - (0.1-2 keV)
Photoemission
spectroscopies

BL04: MSPD
SCW31 - (8-50 keV)
HP/HR
Powder Diffraction

BL22: CLÆSS
MPW80 - (2-63 keV)
Absorption &
Emission Spectroscopies

BL06: XAIRA
IVU19 - (5-25 keV)
Macromolecular Cristallography

BL09: MISTRAL
Bending - (0.27-2.6 keV)
X ray Microscopy

BL20: LOREA
EU125 - (10-450 eV)
ARPES

BL11: NCD
IVU21 - (6-13 keV)
Non Cristalline Diffraction
SAXS/WAXS

BL16: NOTOS
Bending
Metrology, XAS

BL13: XALOC
IVU21 - (5-22 keV)
Macromolecular Cristallography



Operation in 2017

- Statistics
- News
- Improvements





Operation - Statistics

ALBA Operations Calendar, January 2017-December 2017

BL operation	BL	BL Users (external, friendly, in-house & commissioning)
bl operation	bl	BL/FE/ID Commissioning & Accelerator Optimization for BLs
Start-up	M	Start up of accelerators with beam & Accelerator's Studies
Warm-up	W	Warm: Linac & RF & magnets & sub-systems maintenance and optimisation
Shutdown	O	Civil Engineering, Accelerators and BL maintenance with no beam, installations and upgrades
Public & CELLS holiday	H	

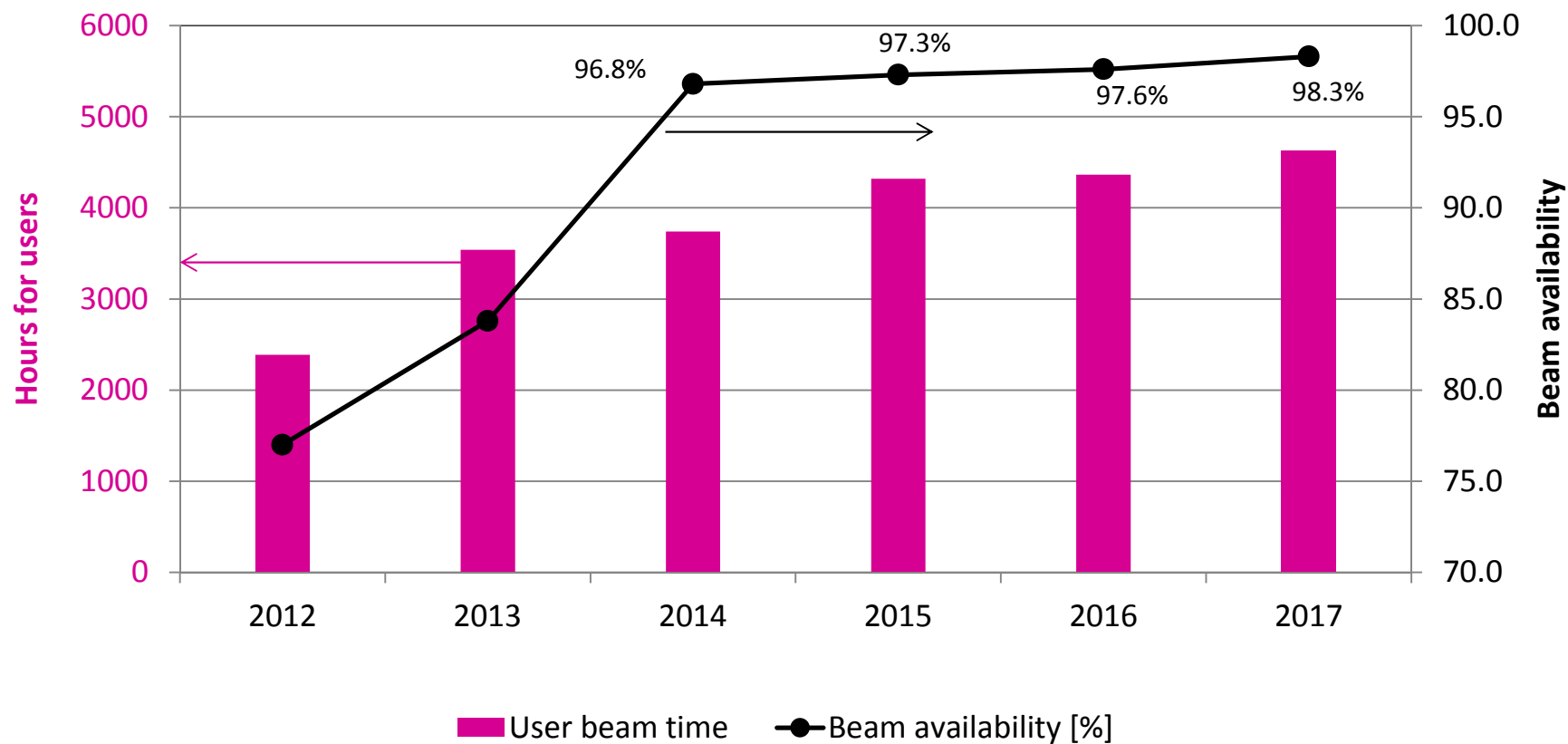
Weekday	January			February			March			April			May			June			July			August			September			October			November			December			
	Day/Week	M	A	N	Day/Week	M	A	N	Day/Week	M	A	N	Day/Week	M	A	N	Day/Week	M	A	N	Day/Week	M	A	N	Day/Week	M	A	N	Day/Week	M	A	N	Day/Week	M	A	N	
Mo																																					
Tu																																					
We					1																																
Th					2																																
Fr					3																																
Sa					4																																
Su	1				5																																
Mo		2	1		6	6																															
Tu		3			7																																
We		4			8																																
Th		5			9																																
Fr		6			10																																
Sa		7			11																																
Su	8				12																																
Mo		9	2		13	7																															
Tu		10			14																																
We		11			15																																
Th		12			16																																
Fr		13			17																																
Sa		14			18																																
Su	15				19																																
Mo		16	3		20	8																															
Tu		17			21																																
We		18			22																																
Th		19			23																																
Fr		20			24																																
Sa		21			25																																
Su	22				26																																
Mo		23	4		27	9																															
Tu		24			28																																
We		25			29																																
Th		26			30																																
Fr		27			31																																
Sa		28																																			
Su	29																																				
Mo		30	5																																		
Tu		31																																			

Total (2017)	5888 h
Machine	1256 h
BL	4632 h

- 24/7
- 8 Runs (4-5 weeks)
- Top-up every 20min



Operation - Statistics

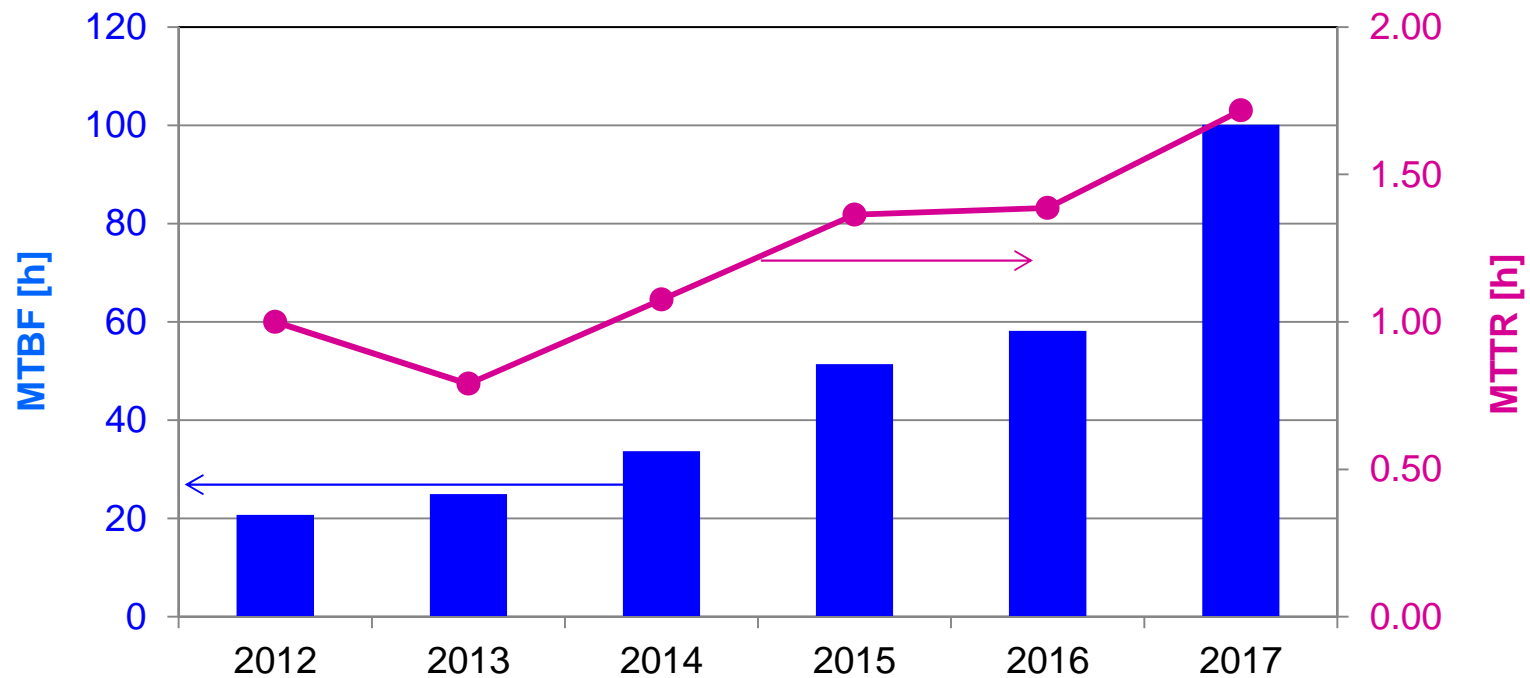


Data for 2017 up to 12 Nov



Operation - Statistics

MTBF & MTTR

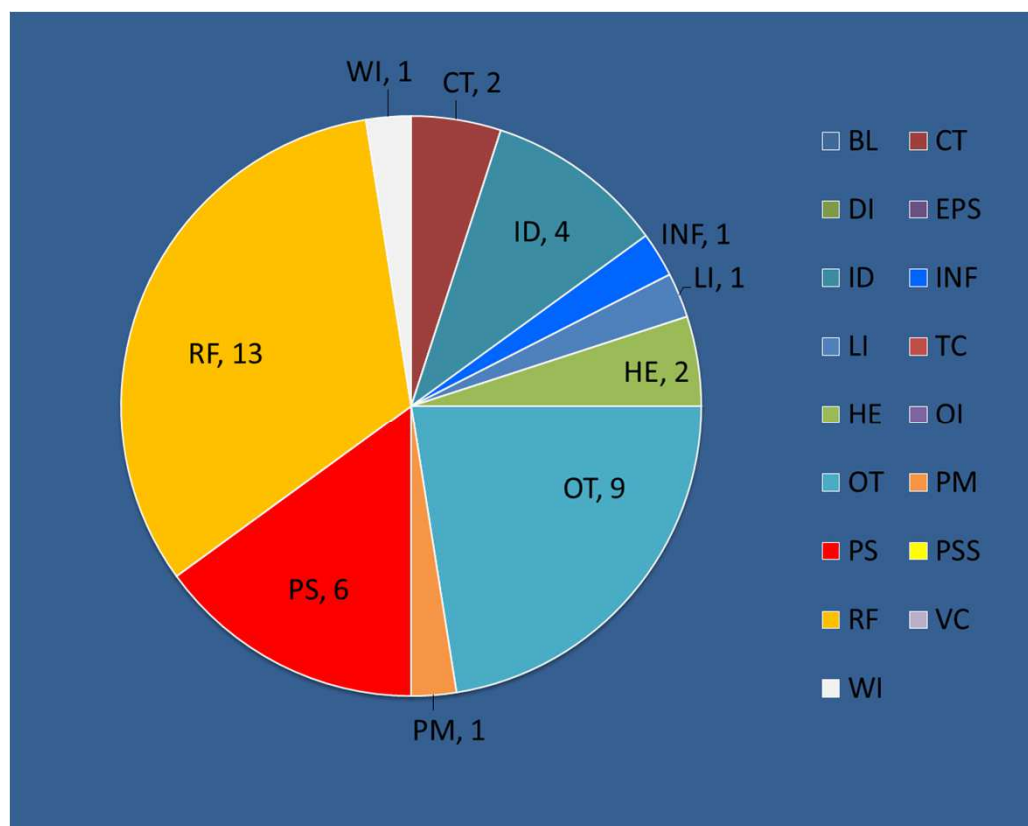


Data for 2017 up to 12 Nov



Operation - Statistics

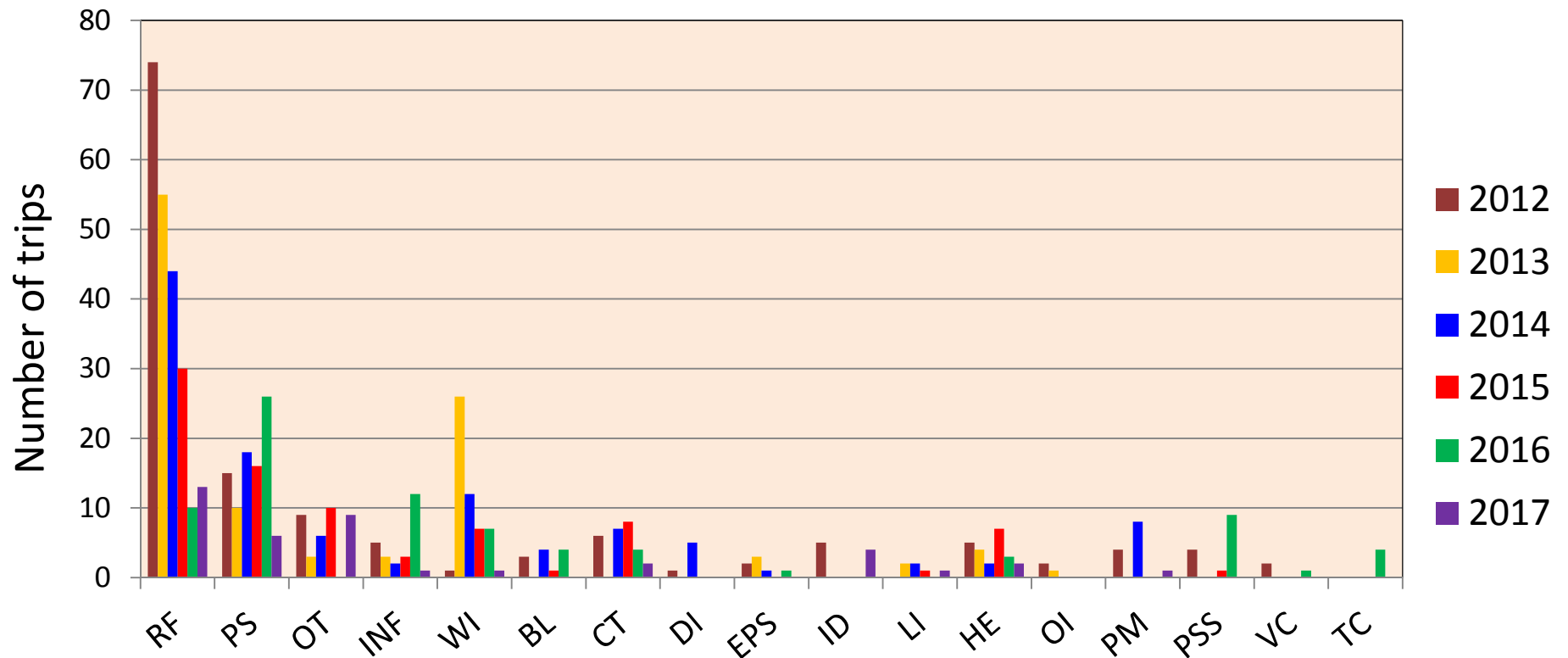
Trips in 2017 (up to Nov 12th)





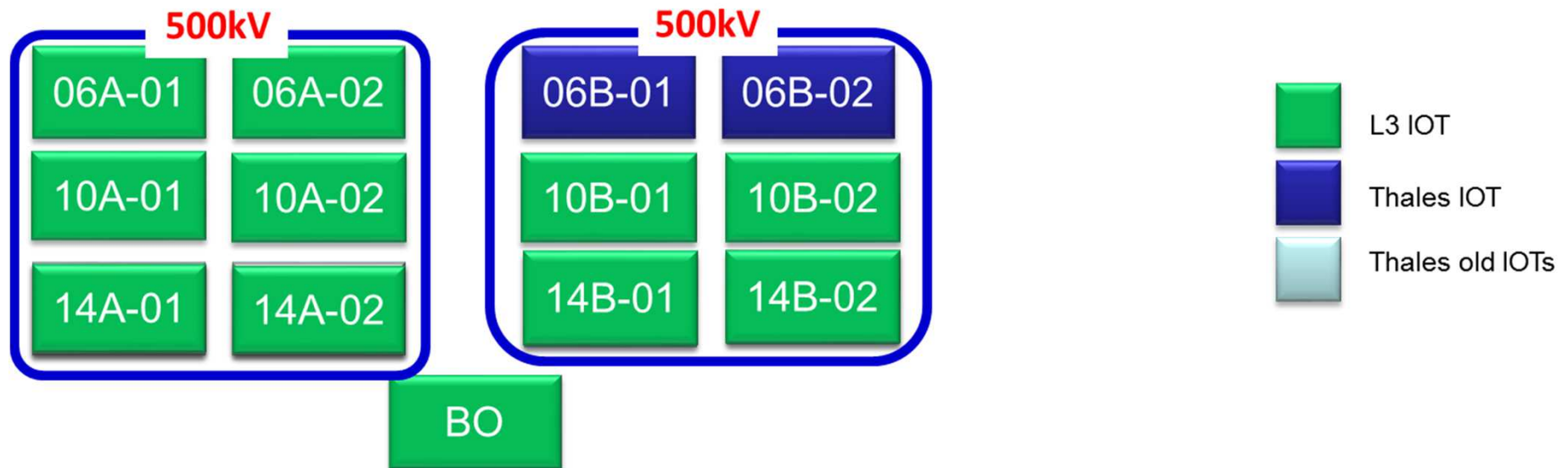
Operation - Statistics

Trips evolution from 2012 to 2017



Operation - News

IOTs upgrade completed: “old” Thales IOTs replaced by L3 & Thales (new model)



Run 06:

All SR cavities at 500kV



Run 07:

Cav conditioning at 600kV

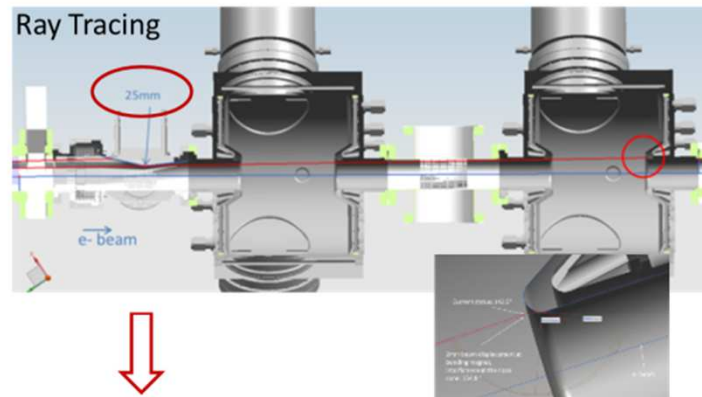
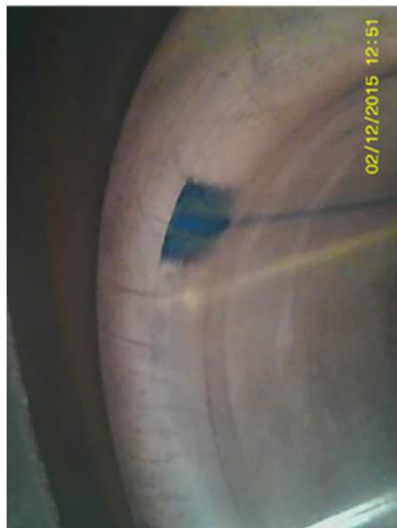


Run 08:

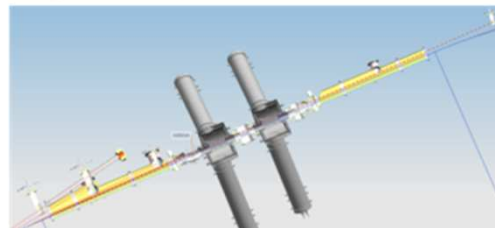
All SR cavities at 550kV

Inspection Cavity S06B

12 Jan 2016



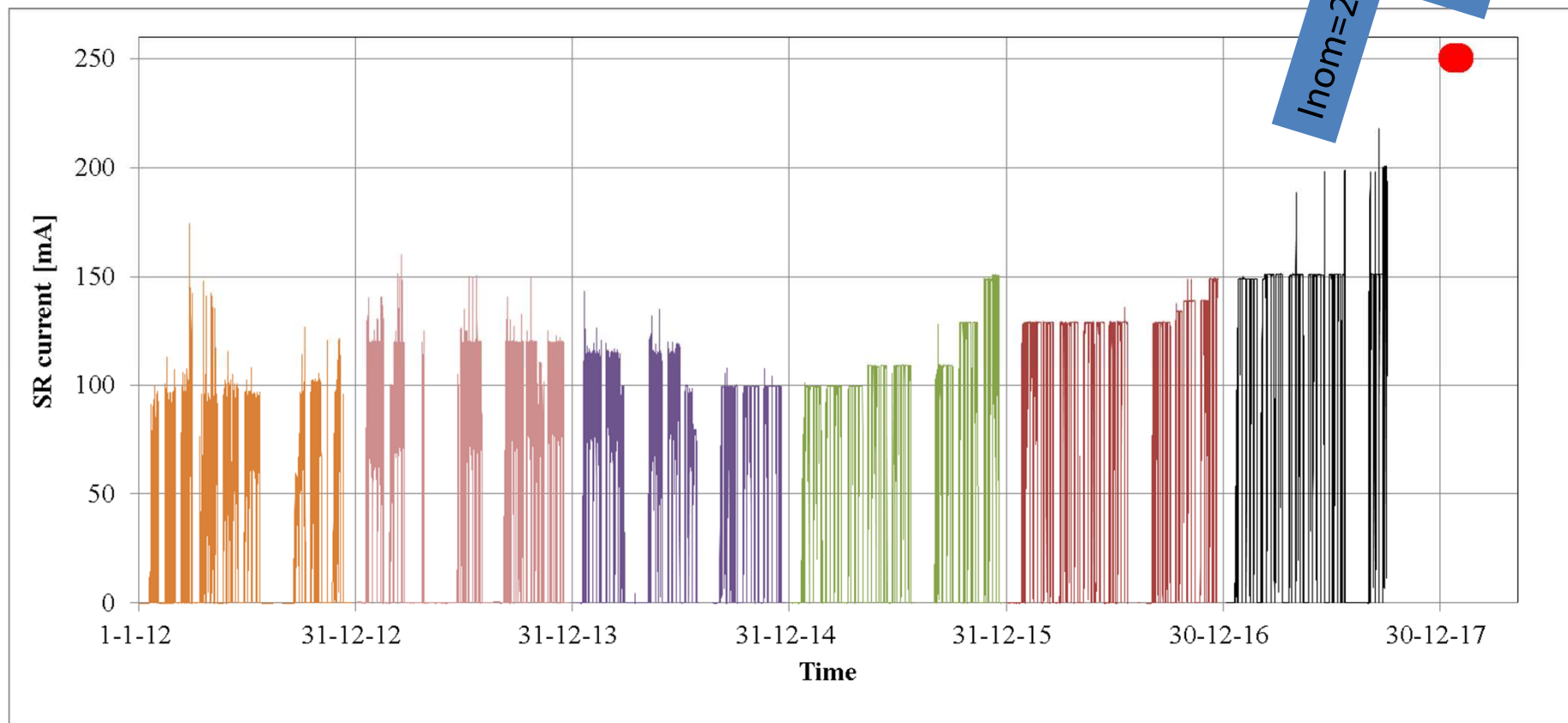
Action: Replace absorber upstream cavities
to enter down to 20-21 mm from beam



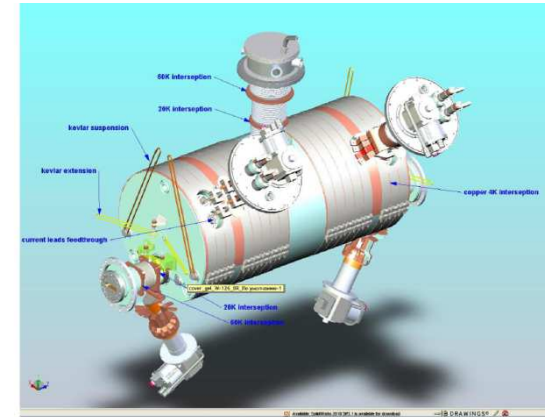
- Voltage in cavity 06A was limited due to arcs
- Confirmed by ray tracing
- Absorber replaced on 16/11/2016
- After that no arcs at “nominal” voltage
- Replaced absorbers also in the other plants

Operation - News

Increasing current in the SR

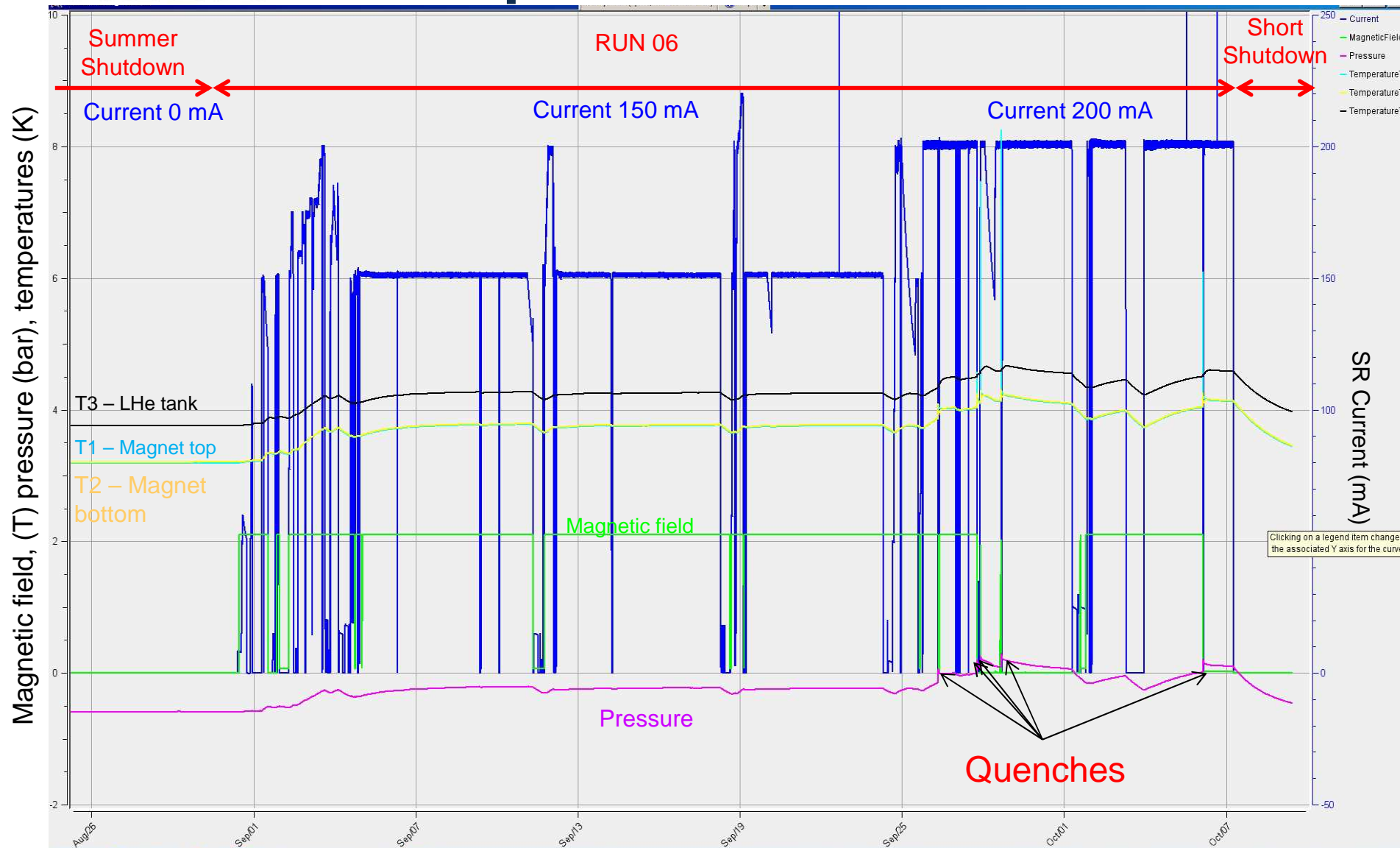


2.1 T SC Wiggler



Liquid helium tank view of the ALBA SC wiggler.

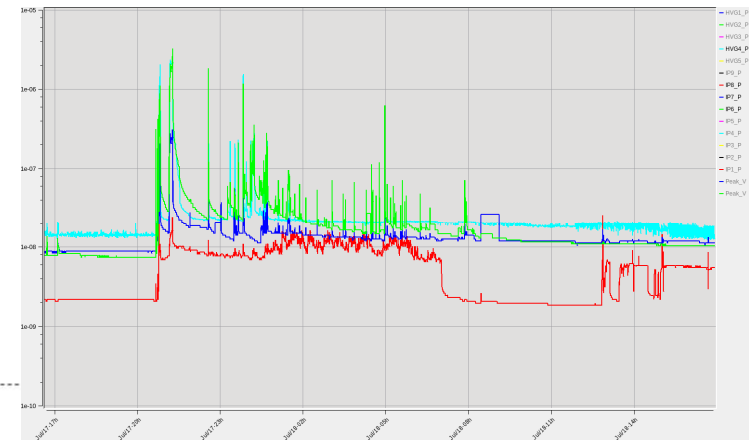
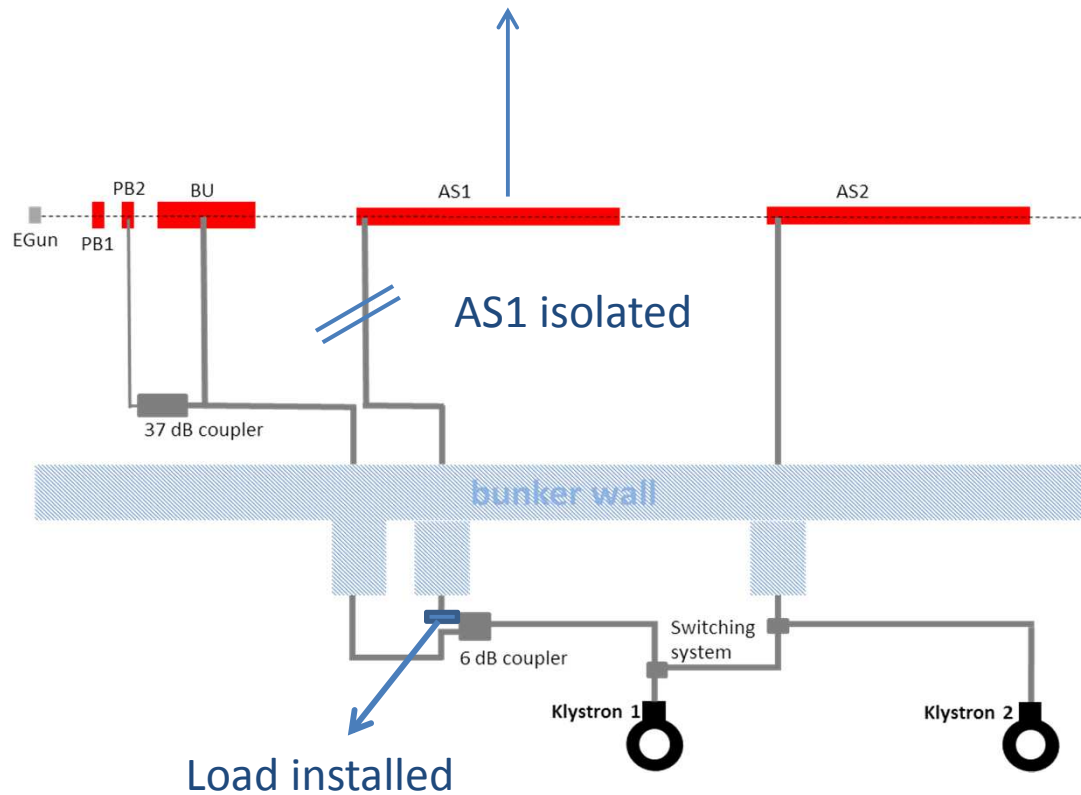
- After the start of operations at 200mA, recurrent quenches
- Observe that above 150mA & depending on filling pattern, there is always heat dissipation on the liner. Continuous increase of cryostat temperature.
- Is there contact between the liner and the I-He tank?
 - ✗ Re-alignment of the liner wrt I-He tank
 - ✓ Operate SR with lower charge per bucket, to keep the same beam power deposition on the liner as when operating 150 mA
- Currently the SCW is awaiting visual inspection scheduled for Jan'18



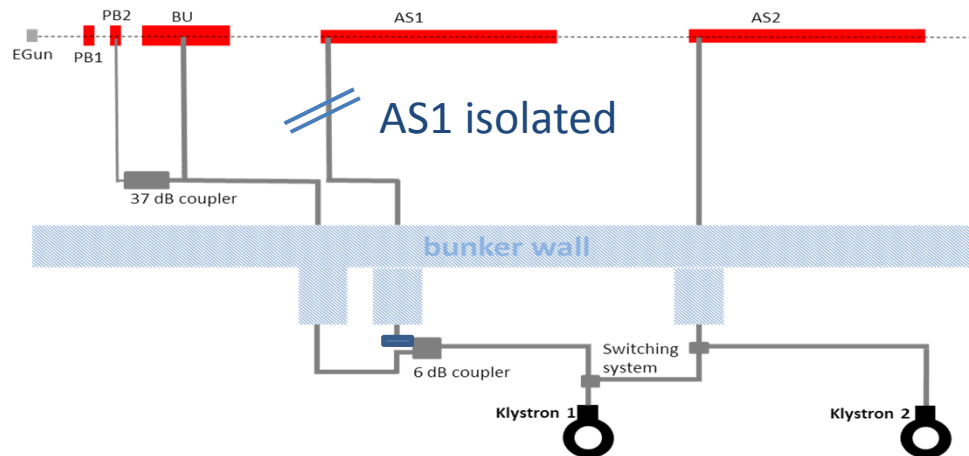
Operation - News

AS1 ceramic window

17/07 at 21h00: Vacuum increase /peaks

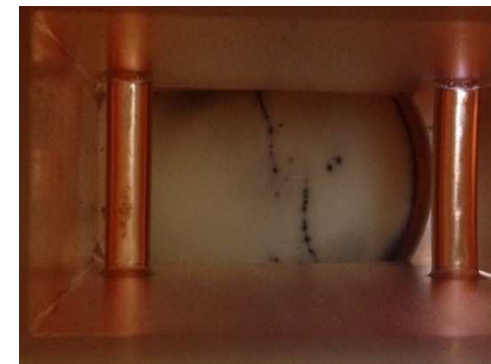


AS1 ceramic window



✓ BO @ 67MeV

- KA1 fed only Buncher. Set at 33 kV (nominal)
- KA2 fed AS2:
 - Set at 27 kV (nominal) → 57 MeV
 - Set at 30 kV + other adjustments → 67 MeV

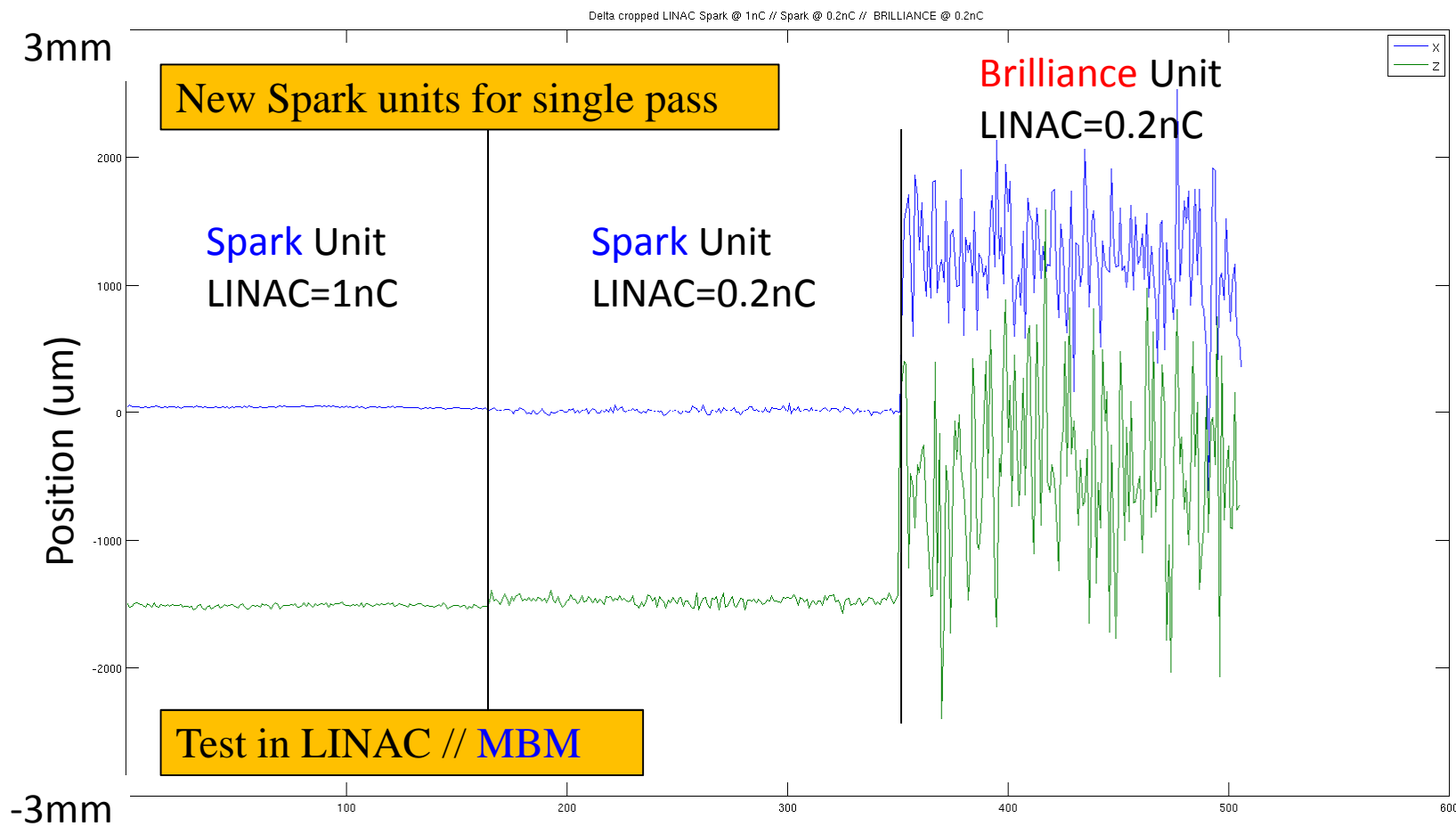


Replacement of window during the shut down



Operation - Improvements

BT BPMS electronic upgrade



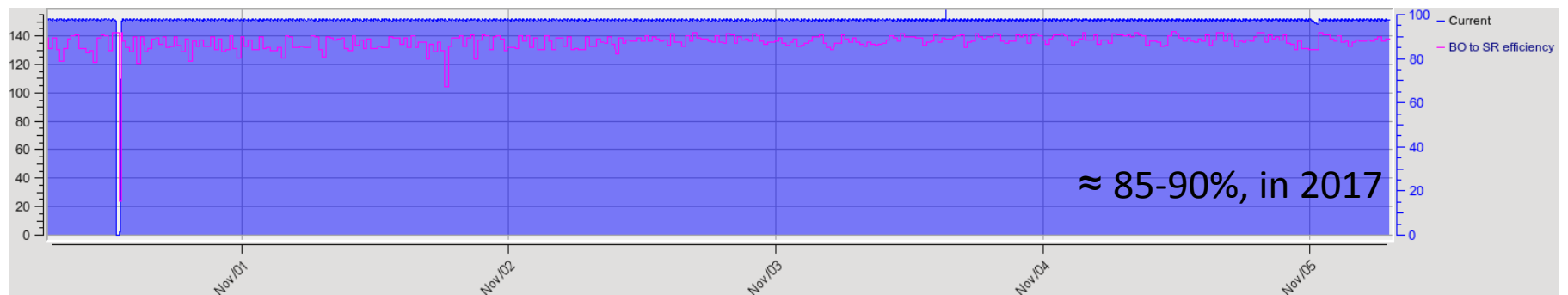
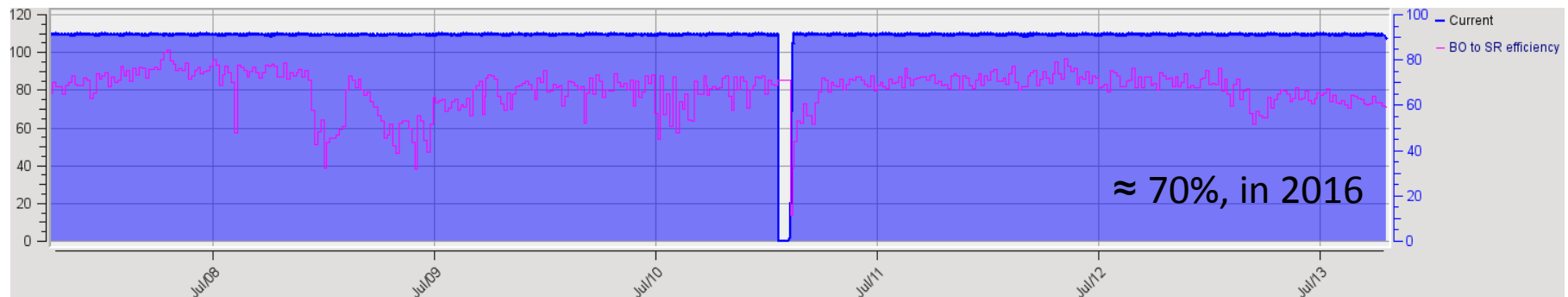


Operation - Improvements

BT realignment

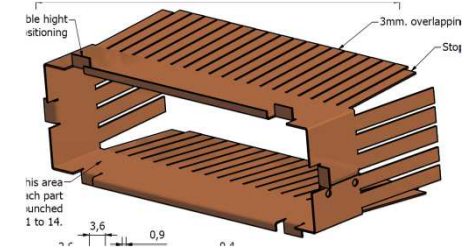
To better control of the Booster to SR injection efficiency

- Beam based alignment
- Use of BT diagnostics (SRM, BPMs) to monitor beam during routine operation



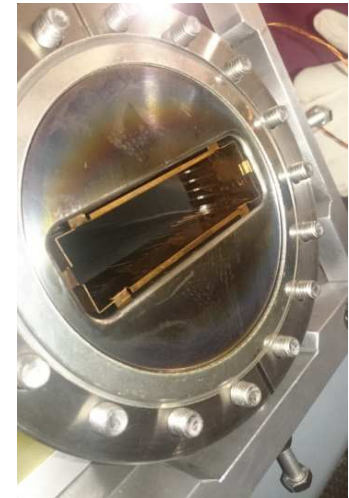
Removal of RF fingers at ceramic chambers

- 5 mm gap between the ceramic tube of the SR_KIINJ and the metallic flange
- Manufacturer provided “sort” of RF fingers
- Very fragile, already 2 replaced due to deformation.
- Always hottest spot in the machine



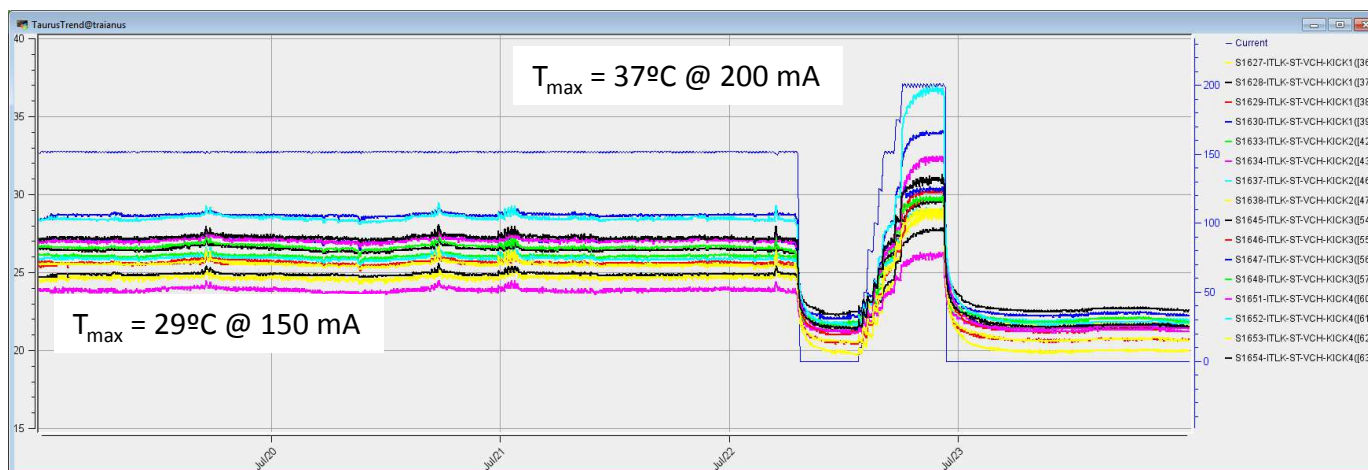
Removal of RF fingers at ceramic chambers

- Revision of the impedance calculations (T.Gunzel) suggest that they could be removed
- May-2017: Remove them at the pinger magnet
- August-2017: Partially removed at the injection straight
- Results are good. Temperatures do not increase anymore.

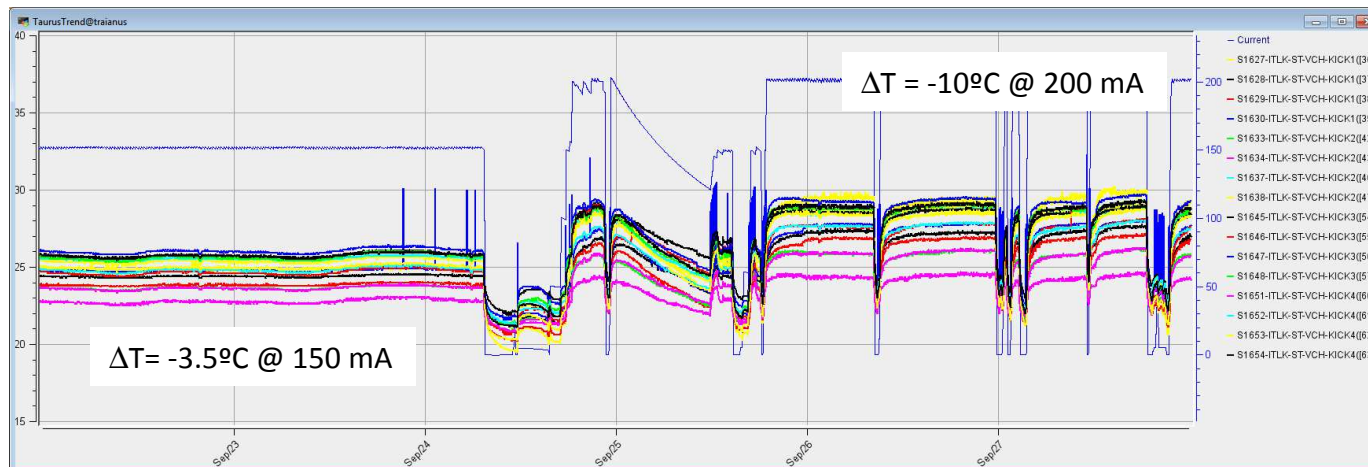


Temperatures @ SR16

July



September





Developments

- New IDs
- RF 3rd harmonic cav
- RF SSA



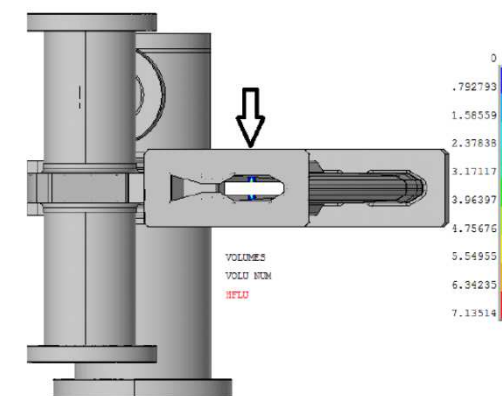
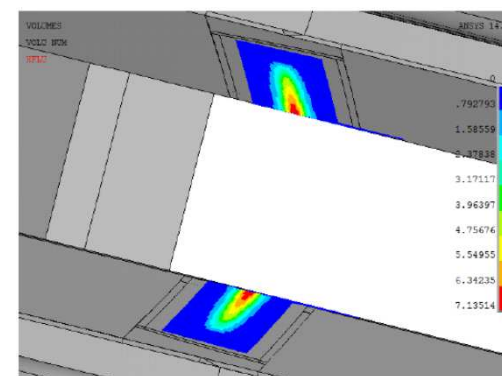


Developments – New IDs

LOREA

Low-Energy Ultra-High-Resolution Angular Photoemission for Complex Materials

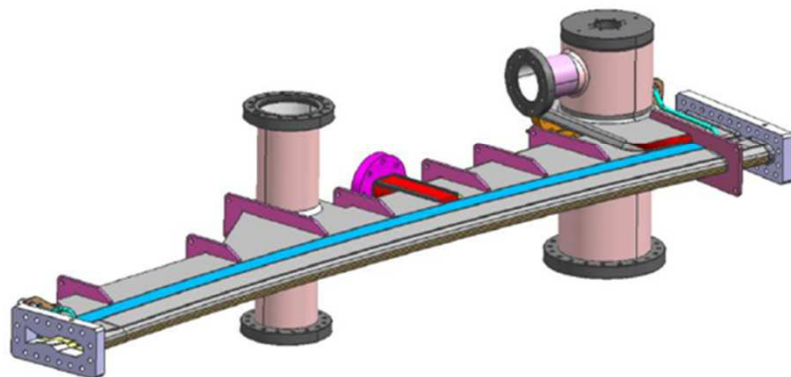
	EU125
Period [mm]	125
Energy range [eV]	10-1500
Polarisation	elliptical
B_0 [T]	1.06
K	12.37
L [m]	2.15
Periods	65
Flux @ 7.75 keV [ph/s/0.1%bw] cm	1.8×10^{13}
Total Power [kW]	6.0



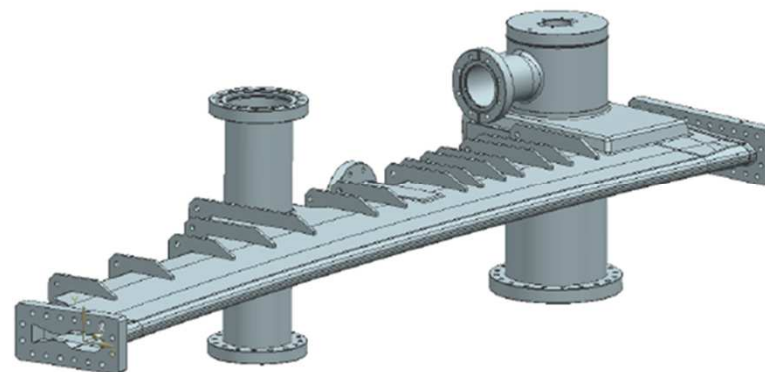


PHASE II – BL20 LOREA

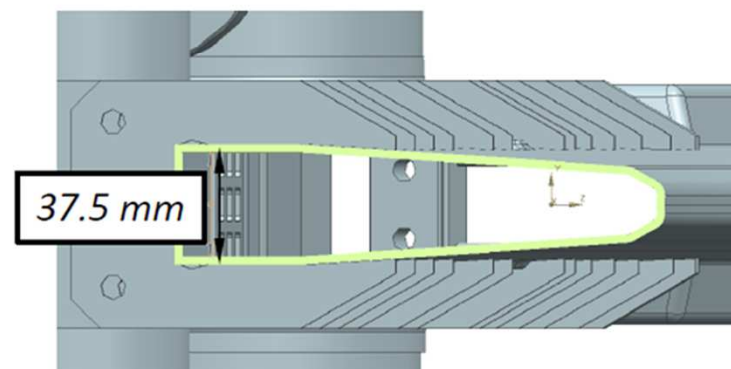
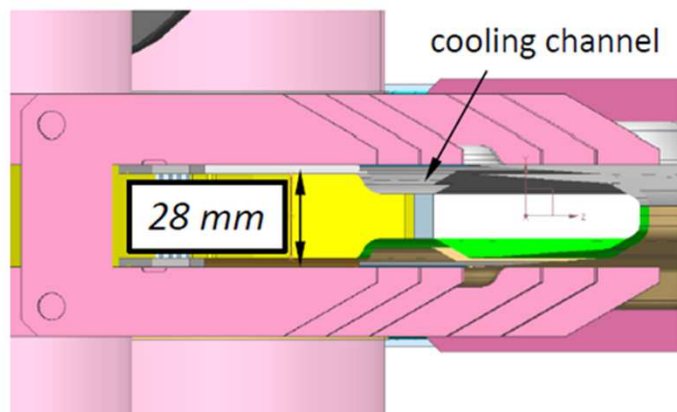
Extreme vertical as well as circular polarization modes of the undulator demands a large acceptance which requires new bending magnet vacuum chamber.



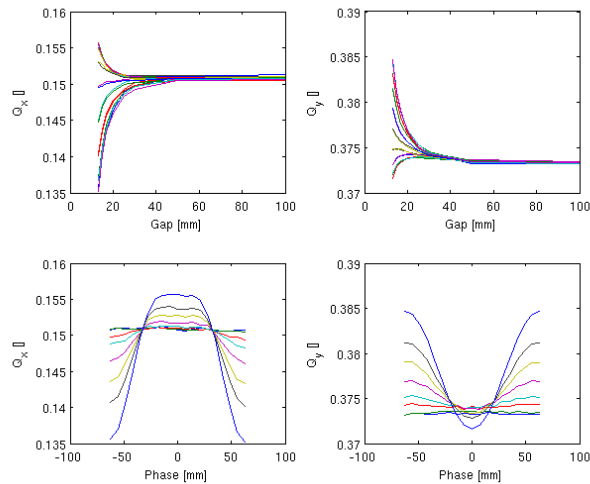
Standard vacuum chamber



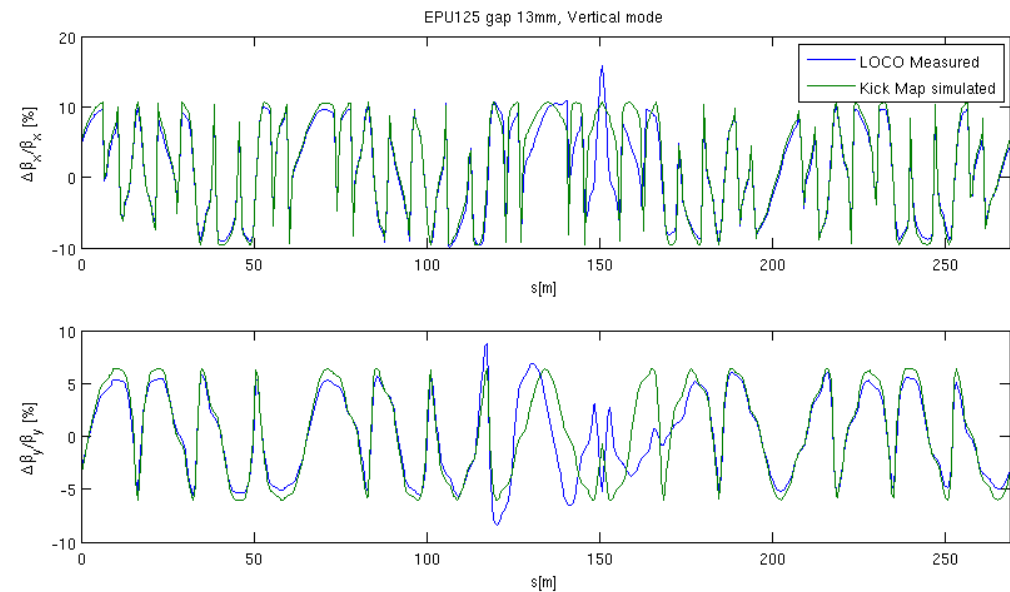
LOREA vacuum chamber



Large detrimental impact on machine parameters



The tune change due to the ID agrees well with the model. Also, the beta beating measured using LOCO agrees quite well except at the ID location.



Model	$\Delta Q_x/\Delta Q_y$ (10^{-2})	$\frac{\Delta\beta_x/\Delta\beta_y}{\beta_x/\beta_y}$ (%)
EPU125H	0.31/0.07	1.98/0.35
EPU125C	-0.60/0.63	4.02/3.39
EPU125V	-1.48/1.15	10.60/6.42

Active shimming based on a set of wires installed on the vacuum chamber

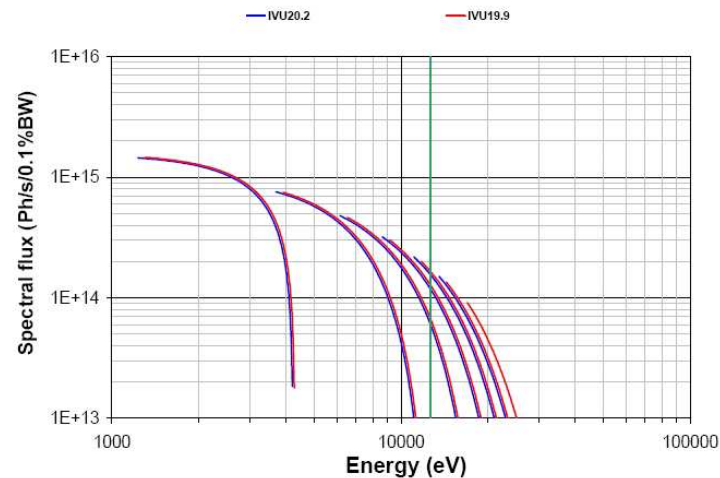
(as Bessy-II and Diamond)

Developments – New IDs

XAIRA

Microfocus BL for Macromolecular Crystallography

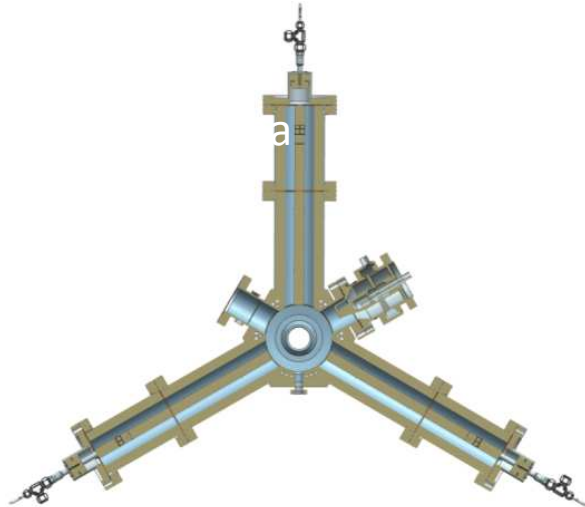
	IVU19
Period [mm]	19.9
B_0 [T]	1.151
K	2.139
L [m]	2.3
Periods	115
Flux @ 12.661keV [ph/s/0.1%bw]	1.65E14
Minimum gap [mm]	4.8 (5.5)
Total Power [kW]	6.9



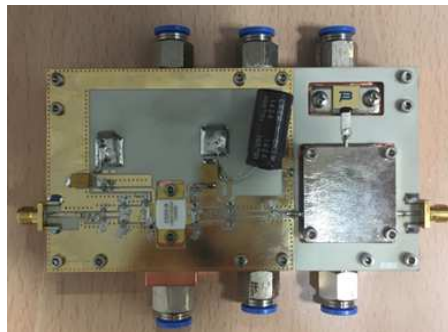
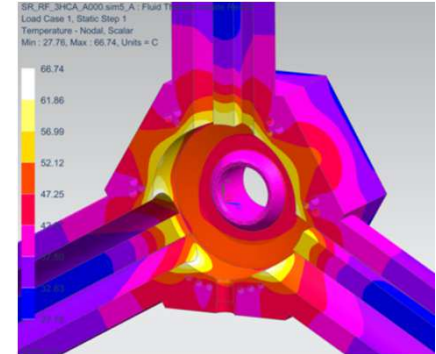
- Minimum impact on machine parameters
 - 10% lifetime reduction
 - No impact on injection efficiency
 - Tune shift (10^{-3}) and beta beating (1%) well corrected with LOCO
- Computing thermal effects due to the emitted power



1.5 GHz 3rd Harmonic Cavity

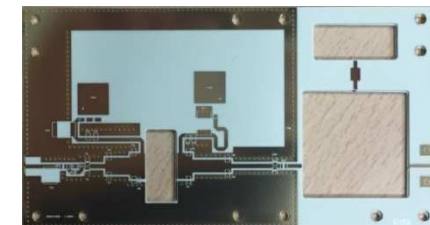


- e-m design done
- Mechanical design done
- Thermal and stress FEA done
- 2D drawings under production
- Considering prototype for 2018



1.5 GHz SSA

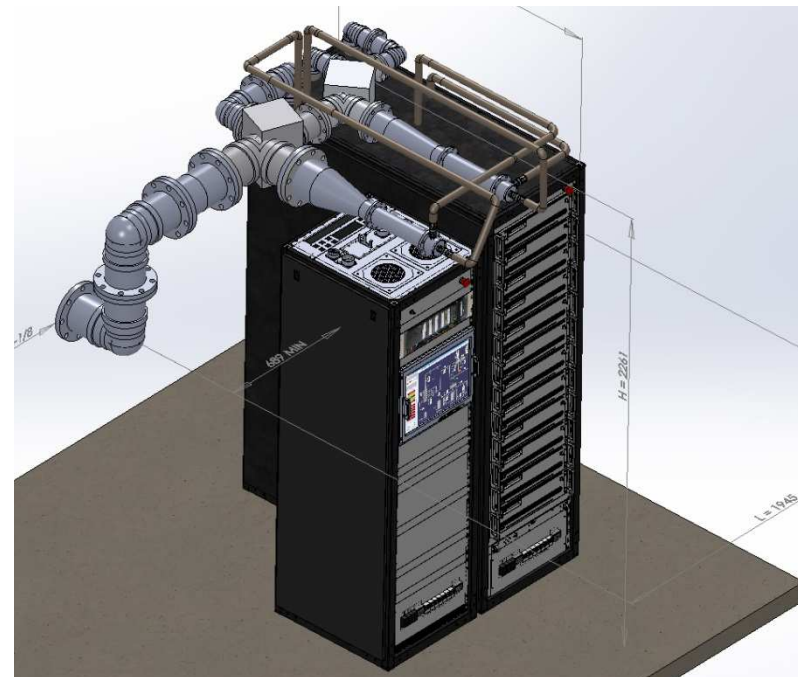
- Development of a 250W power amplifier module
- Using commercial transistors



Developments – SSA

Tender awarded to BTesa to provide 50kW SSA for Booster

- No RF redundancy in Booster (only one amplifier)
- Modularity of SSA amplifiers offers better reliability and redundancy
- SAT foreseen in August 2018





Thanks for your attention