ALBA,
Operation & upgrade status.

Francis Perez

30th ESLS Workshop
December 14th, 2022

Contents

Contents

Operation 2022
8 runs

ALBA Operations Calendar, January 2022-December 2022

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 maintenace and optimisation
Shutdown	Off	Civil Engineering, Accelerators and BL maintenance with no beam, installations and upgrades
Public & CELLS holiday		

Des 2021- Jan 2022	FE MINERVA
Agost 2022	ID & FE FaxTor
	PSS Faxtor

Weekday	JANUARY Week	Day	Shift M	A	N	FEBRUARY Week	Day	Shift M	A	N	MARCH Week		Shift M	A	N	APRIL Week	Day	Shift M	A	N
Mo																				
Tu						5	1	BL	BL	BL	9	1	BL	BL	BL					
We							2	BL	BL	BL		2	BL	BL	BL					
Th							3	BL	BL	BL		3	BL	BL	BL					
Fr							4	BL	BL	BL		4	BL	BL	BL		1	bl	bl	bl
Sa		1	W	W	W		5	BL	BL	BL		5	BL	BL	BL		2	bl	bl	bl
Su		2	W	W	W		6	M	M	M		6	BL	BL	BL		3	M	M	M
Mo		3	W	W	W		7	BL	BL	BL		7	M	M	M		4	W	W	W
Tu	1	4	W	W	W	6	8	BL	BL	BL	10	8	BL	BL	BL	14	5	W	W	W
We		5	W	W	W		9	BL	BL	BL		9	BL	BL	BL		6	W	W	W
Th		6	W	W	W		10	BL	BL	BL		10	BL	BL	BL		7	W	W	W
Fr		7	W	W	W		11	BL	BL	BL		11	BL	BL	BL		8	W	W	W
Sa		8	W	W	W		12	BL	BL	BL		12	BL	BL	BL		9	W	W	W
Su		9	W	W	W		13	BL	BL	BL		13	BL	BL	BL		10	W	W	W
Mo		10	W	W	W		14	M	M	M		14	M	M	M		11	W	W	W
Tu	2	11	W	W	W	7	15	BL	BL	BL	11	15	BL	BL	BL	15	12	W	W	W
We		12	W	W	W		16	BL	BL	BL		16	BL	BL	BL		13	W	W	W
Th		13	M	M	M		17	BL	BL	BL		17	BL	BL	BL		14	W	W	W
Fr		14	M	M	M		18	BL	BL	BL		18	BL	BL	BL		15	W	W	W
Sa		15	M	M	M		19	BL	BL	BL		19	BL	BL	BL		16	W	W	W
Su		16	M	M	M		20	M	M	M		20	BL	BL	BL		17	W	W	W
Mo		17	M	M	M		21	W	W	W		21	M	M	M		18	W	W	W
Tu	3	18	BL	BL	BL	8	22	W	W	W	12	22	BL	BL	BL	16	19	W	W	W
We		19	BL	BL	BL		23	W	W	W		23	BL	BL	BL		20	M	M	M
Th		20	BL	BL	BL		24	W	W	W		24	BL	BL	BL		21	M	M	M
Fr		21	BL	BL	BL		25	W	W	W		25	BL	BL	BL		22	BL	BL	BL
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Su		23	BL	BL	BL		27	W	W	W		27	BL	BL	BL		24	BL	BL	BL
Mo		24	M	M	M		28	M	M	M		28	M	M	M		25	M	M	M
Tu	4	25	BL	BL	BL						13	29	BL	BL	BL	17	26	BL	BL	BL
We		26	BL	BL	BL							30	BL	BL	BL		27	BL	BL	BL
Th		27	BL	BL	BL							31	BL	BL	BL		28	BL	BL	BL
Fr		28	BL	BL	BL												29	BL	BL	BL
Sa		29	BL	BL	BL												30	BL	BL	BL
Su		30	BL	BL	BL															
Mo		31	M	M	M															
Tu																				

Weekday	MAY Week		Shift M	A	N	JUNE Week	Day	Shift M	A	N	JULY Week	Day	Shift M	A	N	AUGUST Week	Day	Shift M	A	N
Mo																	1	Off	Off	Off
Tu																31	2	Off	Off	Off
We							1	BL	BL	BL							3	Off	Off	Off
Th							2	BL	BL	BL							4	Off	Off	Off
Fr							3	BL	BL	BL		1	BL	BL	BL		5	Off	Off	Off
Sa							4	BL	BL	BL		2	BL	BL	BL		6	Off	Off	Off
Su		1	BL	BL	BL		5	BL	BL	BL		3	BL	BL	BL		7	Off	Off	Off
Mo		2	M	M	M		6	M	M	M		4	M	M	M		8	Off	Off	Off
Tu	18	3	BL	BL	BL	23	7	BL	BL	BL	27	5	BL	BL	BL	32	9	Off	Off	Off
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Th		5	BL	BL	BL		9	BL	BL	BL		7	BL	BL	BL		11	Off	Off	Off
Fr		6	BL	BL	BL		10	BL	BL	BL		8	BL	BL	BL		12	Off	Off	Off
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Mo		9	M	M	M		13	M	M	M		11	M	M	M		15	Off	Off	Off
Tu	19	10	BL	BL	BL	24	14	BL	BL	BL	28	12	BL	BL	BL	33	16	Off	Off	Off
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Th		12	BL	BL	BL		16	BL	BL	BL		14	BL	BL	BL		18	Off	Off	Off
Fr		13	BL	BL	BL		17	BL	BL	BL		15	BL	BL	BL		19	Off	Off	Off
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Su		15	M	M	M		19	M	M	M		17	BL	BL	BL		21	W	W	W
Mo		16	W	W	W		20	W	W	W		18	M	M	M		22	PSS	W	W
Tu	20	17	W	W	W	25	21	W	W	W	29	19	BL	BL	BL	34	23	PSS	W	W
We		18	W	W	W		22	W	W	W		20	BL	BL	BL		24	PSS	W	W
Th		19	W	W	W		23	W	W	W		21	BL	BL	BL		25	PSS	W	W
Fr		20	W	W	W		24	W	W	W		22	BL	BL	BL		26	PSS	W	W
Sa		21	W	W	W		25	W	W	W		23	BL	BL	BL		27	SPR*	W	W
Su		22	W	W	W		26	W	W	W		24	M	M	M		28	SPR*	W	W
Mo		23	M	M	M		27	M	M	M		25	W	W	Off		29	SPR*	W	W
Tu	21	24	BL	BL	BL	26	28	BL	BL	BL	30	26	Off	Off	Off	35	30	SPR*	W	W
We		25	BL	BL	BL		29	BL	BL	BL		27	Off	Off	Off		31	W	W	W
Th		26	BL	BL	BL		30	BL	BL	BL		28	Off	Off	Off					
Fr		27	BL	BL	BL							29	Off	Off	Off					
Sa		28	BL	BL	BL							30	Off	Off	Off					
Su		29	BL	BL	BL							31	Off	Off	Off					
Mo		30	M	M	M															
Tu	22	31	BL	BL	BL															

Weekday	SETEMBER Week	Day	Shift M	A	N	OCTOBER Week	Day	Shift M	A	N	NOVEMBER Week	Day	Shift M	A	N	DECEMBER Week	Day	Shift M	A	N
Mo																				
Tu											44	1	BL	BL	BL					
We												2	BL	BL	BL					
Th		1	M	M	M							3	BL	BL	BL		1	BL	BL	BL
Fr		2	M	M	M							4	BL	BL	BL		2	BL	BL	BL
Sa		3	M	M	M		1	BL	BL	BL		5	BL	BL	BL		3	BL	BL	BL
Su		4	M	M	M		2	M	M	M		6	M	M	M		4	BL	BL	BL
Mo		5	M	M	M		3	PSS	W	W		7	SPR	W	W		5	M	M	M
Tu	36	6	BL	BL	BL	40	4	PSS	W	W	45	8	PSS	W	W	49	6	BL	BL	BL
We		7	BL	BL	BL		5	W	W	W		9	PSS	W	W		7	BL	BL	BL
Th		8	BL	BL	BL		6	W	W	W		10	W	W	W		8	BL	BL	BL
Fr		9	BL	BL	BL		7	W	W	W		11	W	W	W		9	BL	BL	BL
Sa		10	BL	BL	BL		8	W	W	W		12	W	W	W		10	BL	BL	BL
Su		11	BL	BL	BL		9	W	W	W		13	W	W	W		11	BL	BL	BL
Mo		12	M	M	M		10	M	M	M		14	M	M	M		12	M	M	M
Tu	37	13	BL	BL	BL	41	11	BL	BL	BL	46	15	BL	BL	BL	50	13	BL	BL	BL
We		14	BL	BL	BL		12	BL	BL	BL		16	BL	BL	BL		14	BL	BL	BL
Th		15	BL	BL	BL		13	BL	BL	BL		17	BL	BL	BL		15	BL	BL	BL
Fr		16	BL	BL	BL		14	BL	BL	BL		18	BL	BL	BL		16	BL	BL	BL
Sa		17	BL	BL	BL		15	BL	BL	BL		19	BL	BL	BL		17	W	W	W
Su		18	M	M	M		16	BL	BL	BL		20	BL	BL	BL		18	W	W	W
Mo		19	BL	BL	BL		17	M	M	M		21	M	M	M		19	W	W	W
Tu	38	20	BL	BL	BL	42	18	BL	BL	BL	47	22	BL	BL	BL	51	20	W	W	W
We		21	BL	BL	BL		19	BL	BL	BL		23	BL	BL	BL		21	W	W	W
Th		22	BL	BL	BL		20	BL	BL	BL		24	BL	BL	BL		22	W	W	W
Fr		23	BL	BL	BL		21	BL	BL	BL		25	BL	BL	BL		23	W	W	W
Sa		24	BL	BL	BL		22	BL	BL	BL		26	BL	BL	BL		24	W	W	W
Su		25	BL	BL	BL		23	BL	BL	BL		27	BL	BL	BL		25	W	W	W
Mo		26	M	M	M		24	M	M	M		28	M	M	M		26	W	W	W
Tu	39	27	BL	BL	BL	43	25	BL	BL	BL	48	29	BL	BL	BL	52	27	W	W	W
We		28	BL	BL	BL		26	BL	BL	BL		30	BL	BL	BL		28	W	W	W
Th		29	BL	BL	BL		27	BL	BL	BL							29	W	W	W
Fr		30	BL	BL	BL		28	BL	BL	BL							30	W	W	W
Sa							29	BL	BL	BL							31	W	W	W
Su							30	BL	BL	BL										
Mo							31	M	M	M										
Tu																				

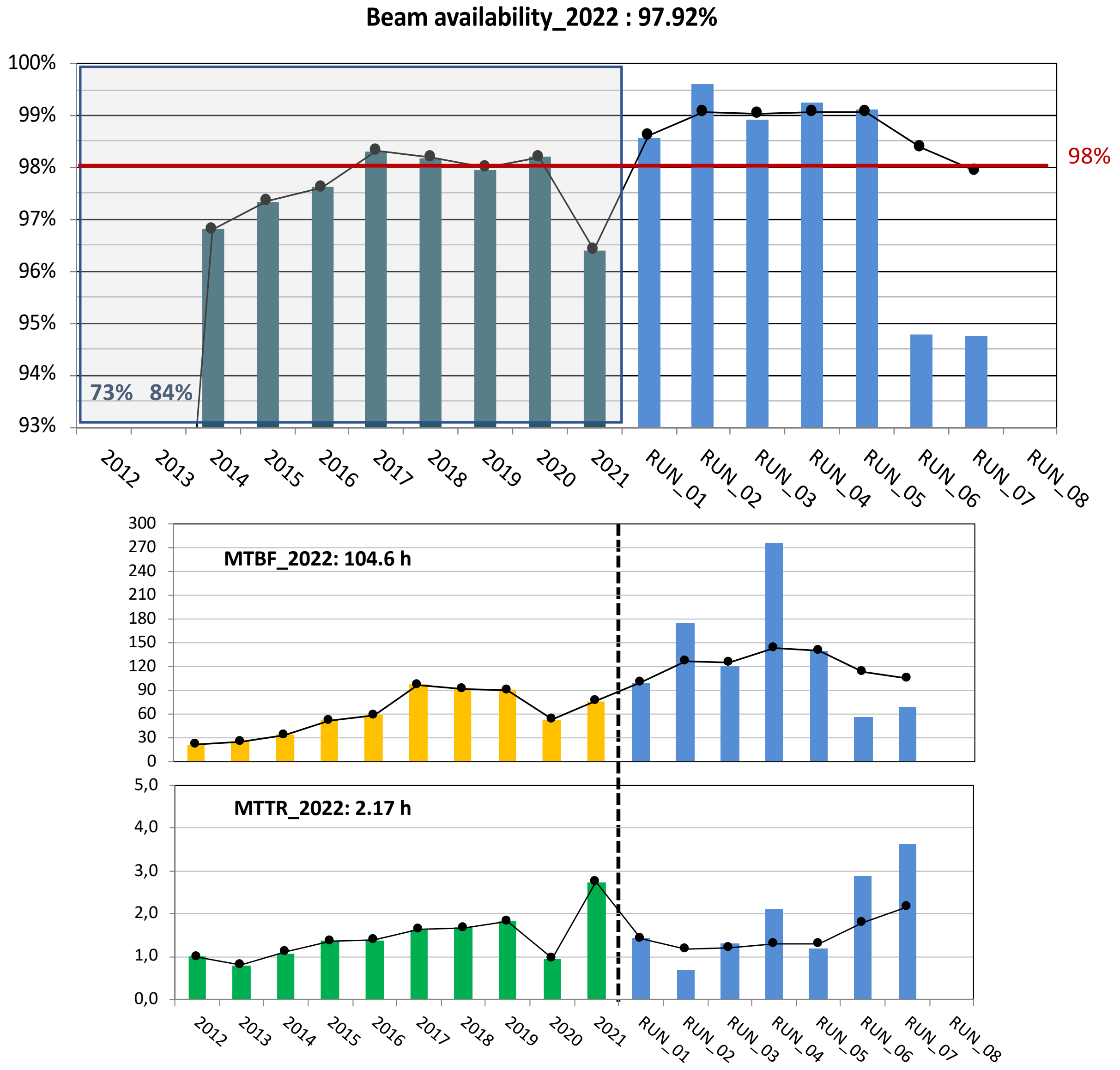
2022 versio 1.0
16/09/2021, MBM approved

Introduce PSS days
8 shut downs
25 days off in August
"bl" days for XAIRA commissioning
with official holidays

	2022		
	shifts	hours	
M	153	1.224	20%
BL	**594**	**4.752**	**80%**
Total	735	5.976	

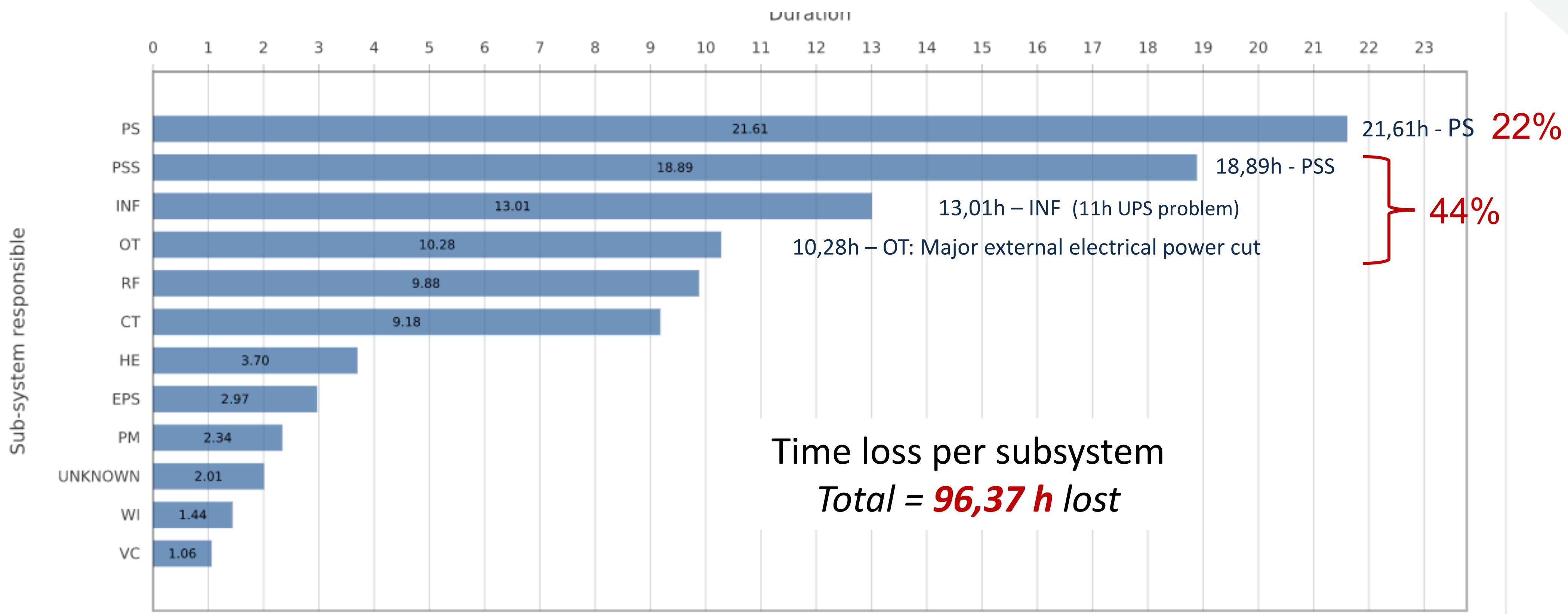
Beam Availability

(until Run07)



No beam events *(until 12/12/2022)*

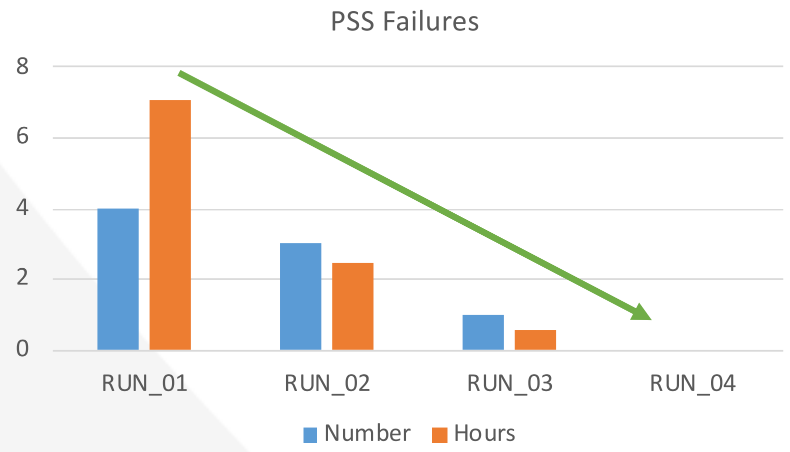
BL	*Beamlines*
CT	*Controls*
DI	*Diagnostics*
EPS	*EPS interlock*
ID	*Insertion Devices*
INF	*Infrastructure*
LI	*Linac*
TC	*Temperature*
HE	*Human error*
OI	*Orbit Interlock*
OT	*Others*
PM	*Pulsed magnets*
PS	*Power Supplies*
PSS	*PSS*
RF	*Radio Frequency*
VC	*Vacuum*
WI	*Water interlocks*



PSS Faults

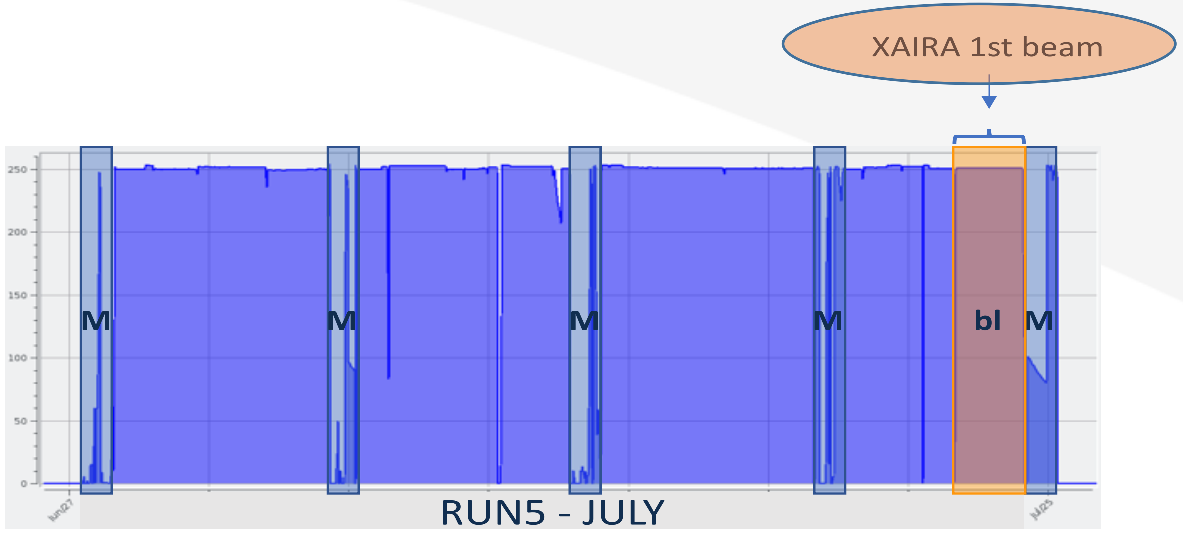
- Following the analysis of the incidents related to the PSS occurred during 2021-Q4 and 2022-Q1 it has been identified that the main source of issues is the system hardware failure, closely related to aging.

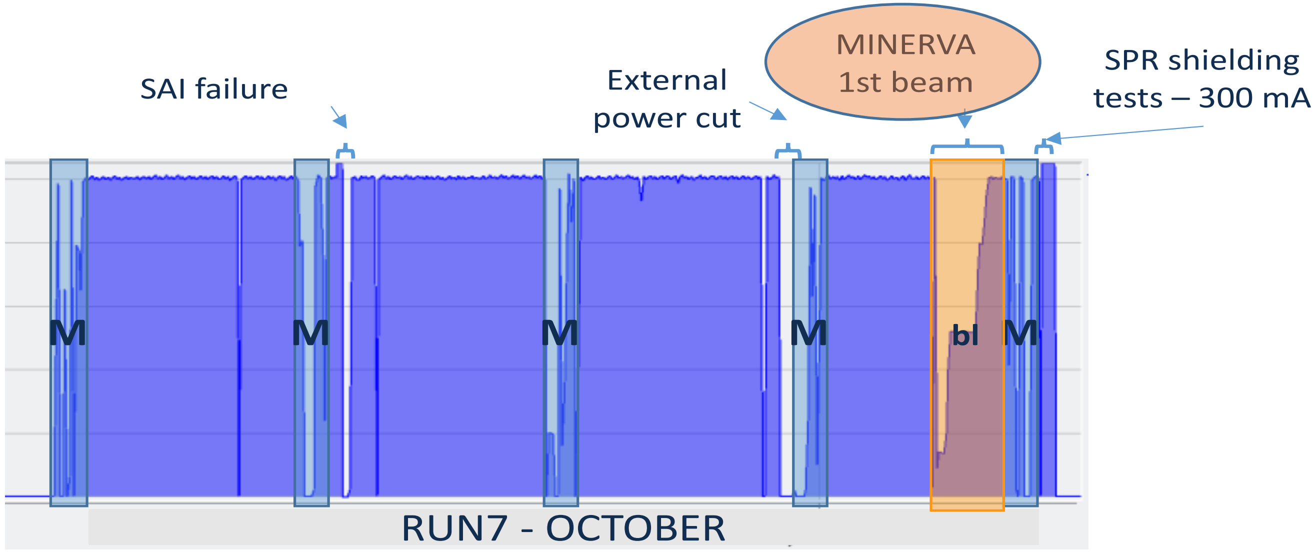
- Also identified during 2022-Q2 various beam lost related to Safe communication failures between PSS TUNNEL (obsolete PSS3000 system) and the new beamlines (PSS4000 series)



- **PSS - Summary of actions taken:**
  - Performed corrective actions following PSS failures. Specially: replacement of PSS3000 CPUs, remote IOs and field equipment.
  - Replaced and certified key Ethernet hardware. The selection and test of new Ethernet switches is being performed in coordination with CELLS IT Systems.
  - Fully certified the SafetyBus by Pilz.
  - Improved PSS Gateway diagnostics.
  - Increased critical stock in order to cover growing number of corrective and preventive interventions.
  - Pilz interventions focused on system diagnostics and troubleshooting (05/04/22 and 16/05/22) point list of actions (20/06/22 and Summer22 shutdown).

2 new beamlines in operation

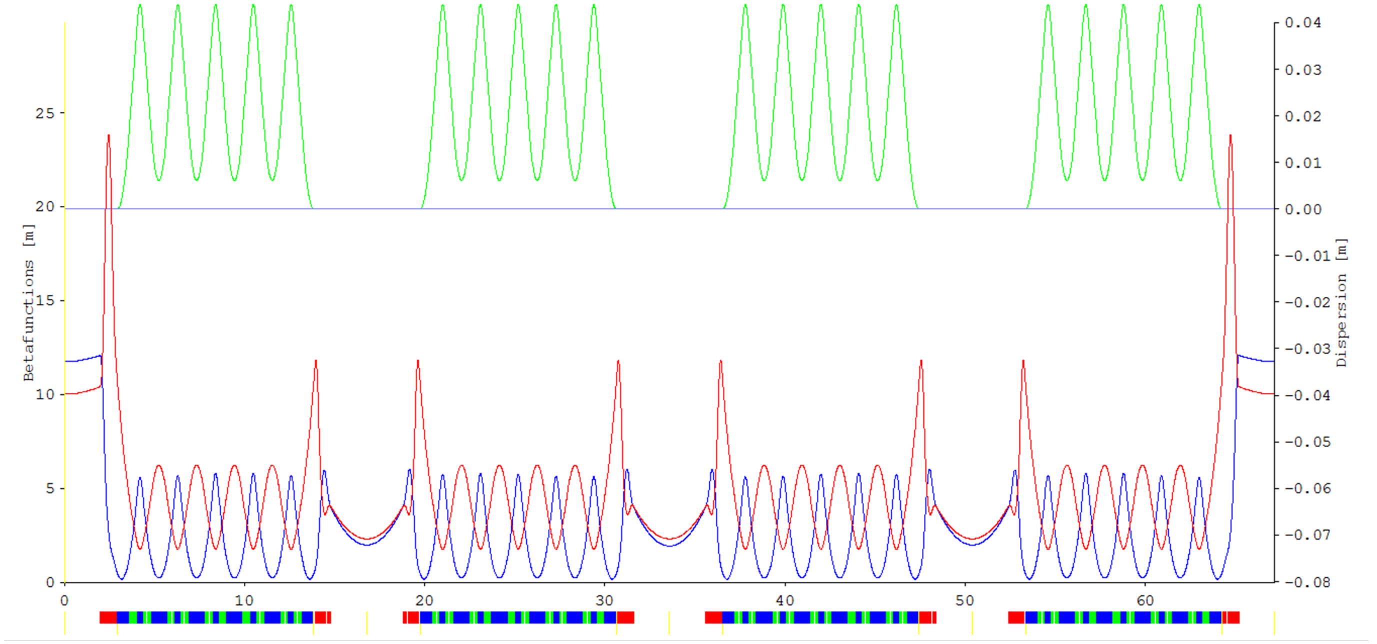


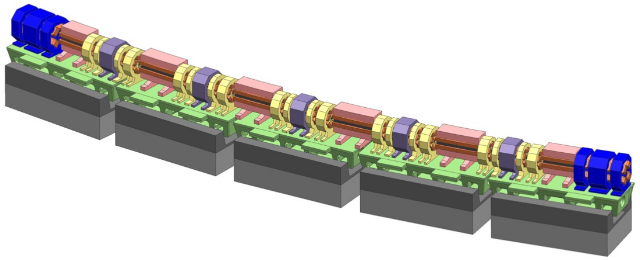


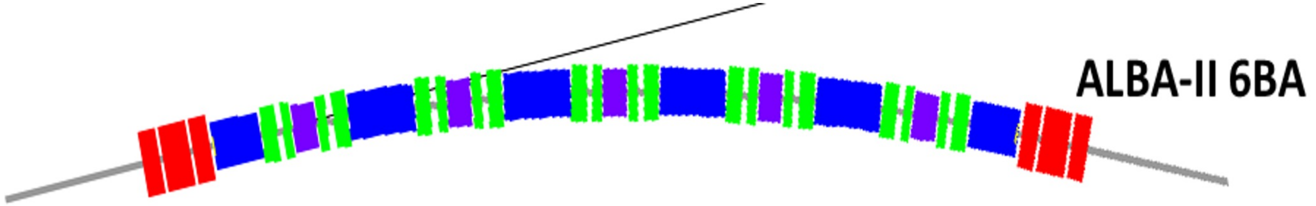
Contents

ALBA II - 6BA lattice

	ALBA	ALBA-II
Emittance	4.5 nm·rad	140 pm·rad
Energy	3 GeV	3 GeV
Circunference	269 m	269 m
Number of cells	8 + 8	16
Number of straights	4 / 12 / 8	16
Straigh lenghts	7.8 / 4.2 / 2.3	4.0 m
Straight ratio	36%	24%
Working point	18.15, 8.36	43.68, 11.67
Chromaticity	-39, -29	-94, -51
Mom. comp. factor	$8.9 \cdot 10^{-4}$	$0.8 \cdot 10^{-4}$
Energy spread	$1.0 \cdot 10^{-3}$	$1.1 \cdot 10^{-3}$
Energy loss per turn	1023 keV	843 keV
Damping times	4 / 5 / 3 ms	3 / 6 / 6 ms





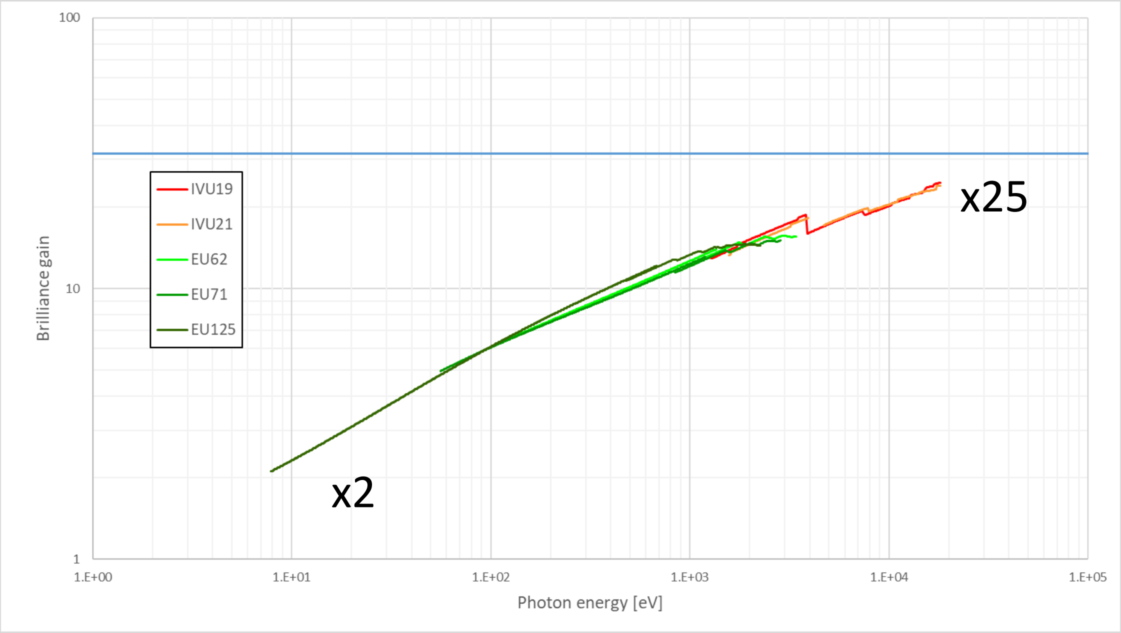


6 transverse gradient BENDS
5 transverse gradient ANTI-BENDS

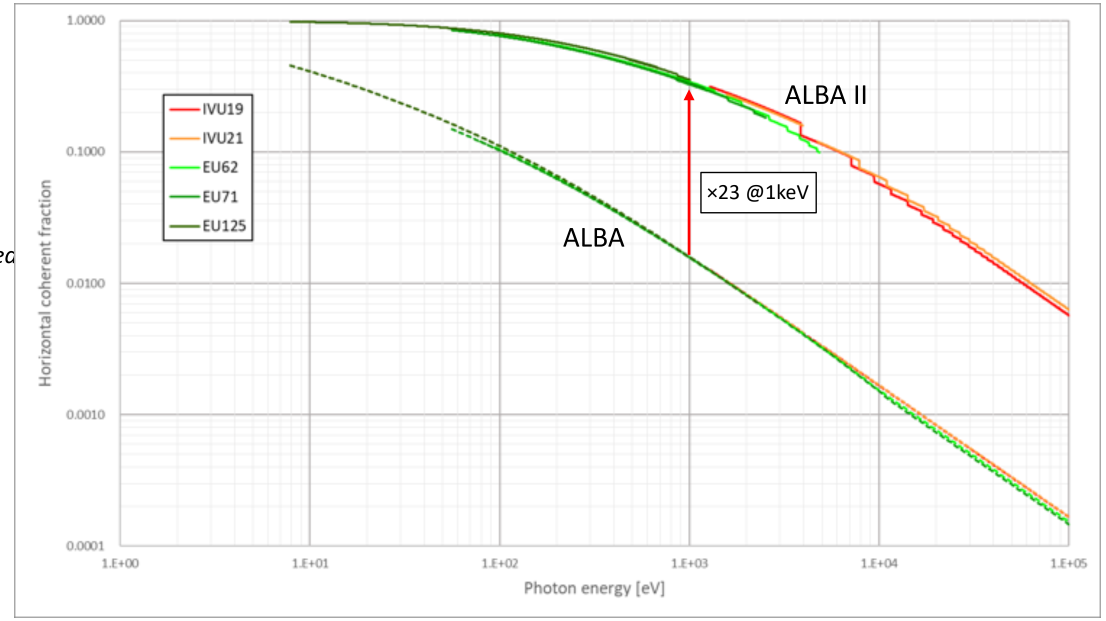
6 matching QUADS
2 families of 10 SEXT

Undulators gains

- **Gain in brilliance** as a function of photon energy
- The **gain** is **larger at higher photon energies**, with an **upper limit** given by the **factor 30** reduction in the **phase space volume of the electron beam** ($\sigma_x\sigma_y\sigma'_x\sigma'_y$)

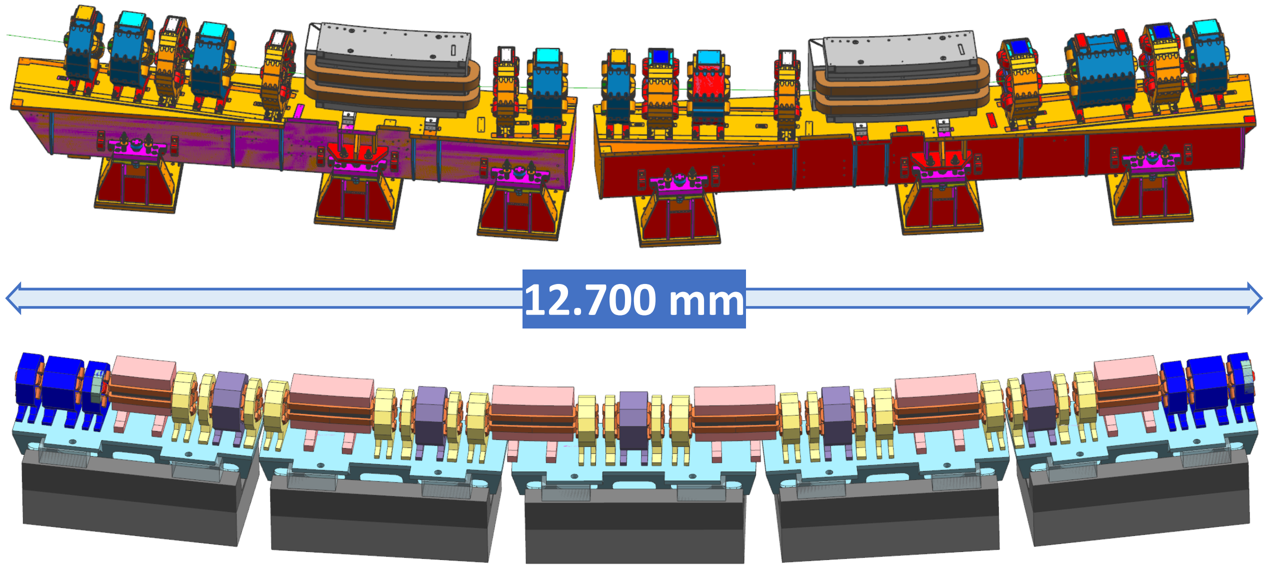


- We have also estimated the improvement in the **horizontal coherent fraction** between ALBA and ALBA II (estimated using SPECTRA in Gaussian approximation)



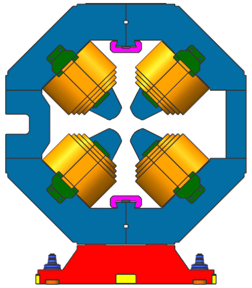
From ALBA to ALBA II

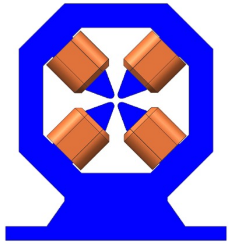
Cell Architecture



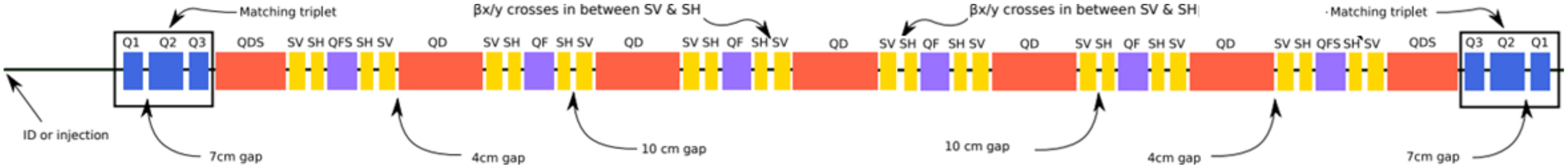
ALBA
Total magnet equivalent length:
6.180 mm
Compactness:
6,18/12,7 = 49 %

ALBA II
Total magnet equivalent length:
10.130 mm
Compactness:
10,13/12,7 = ***80 %***





~21 % of ZX shrinkage:
Dipole 20 %
Quad 20%.
Sext 23 %.



ALBA II Enabling Technologies Project
ALBA 01 (2022 - 2025)

PROYECTO: "DESARROLLO DE TECNOLOGÍA AVANZADA PARA ALBA-II"

El proyecto de una fuente de luz de sincrotrón de 4ª generación está basado en tecnologías avanzadas, muchas de las cuales se están actualmente desarrollando en el mundo, obedeciendo a las necesidades de los varios proyectos de nuevos sincrotrones y de renovación de los actuales.

Un proyecto como ALBA II necesita un estudio de viabilidad que incluya la construcción de prototipos de los sistemas que se desarrollan por primera vez y la evaluación de su compatibilidad recíproca.

Design, and prototype construction of:

- Magnets
- NEG Coated vacuum chambers
- Pulsed magnets
- Girder for arc assembly tests

Nano-positioning lab

Superconducting Undulator

ALBA 01

Ayuda **ICTS-MRR-2021-02-CELLS** financiada por:

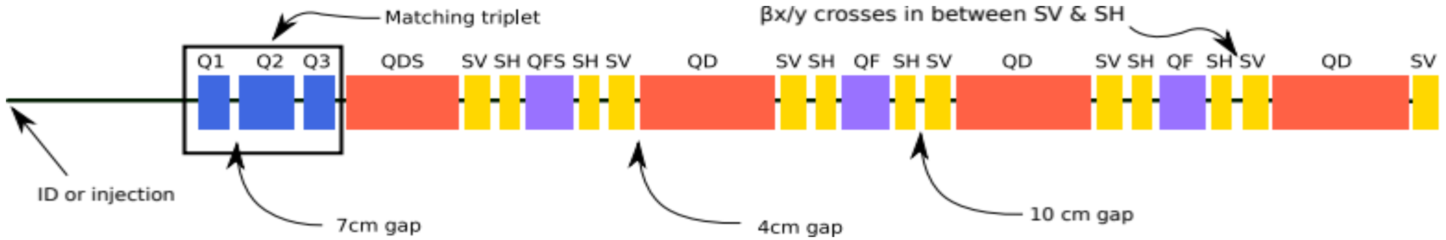
GOBIERNO DE ESPAÑA MINISTERIO DE CIENCIA E INNOVACIÓN

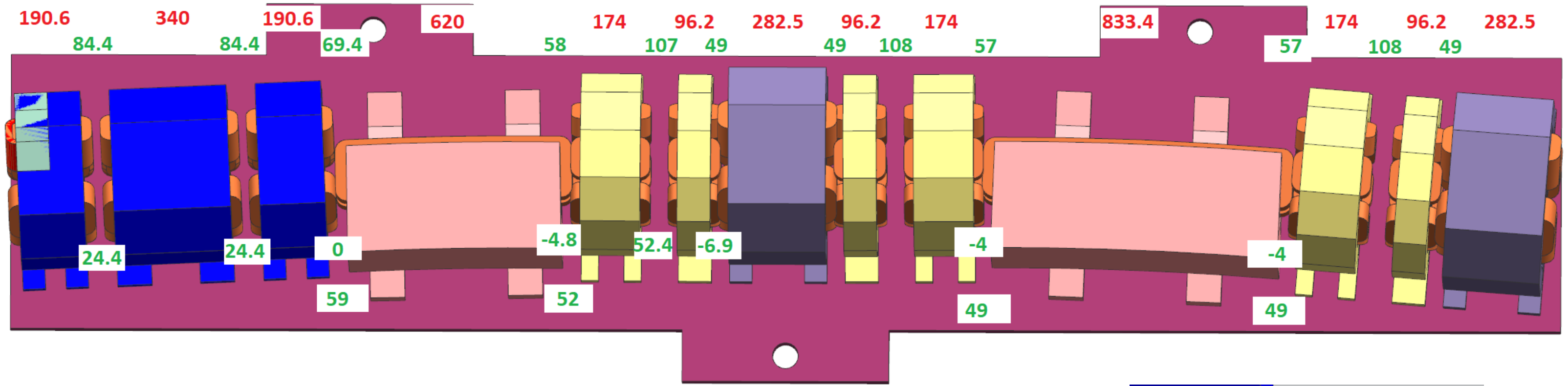
Plan de Recuperación, Transformación y Resiliencia

Financiado por la Unión Europea NextGenerationEU

ALBA 01
Ayuda ICTS-MRR-2021-02-CELLS financiada por:
Plan de Recuperación, Transformación y Resiliencia
Financiado por la Unión Europea NextGenerationEU

Distances and interferences

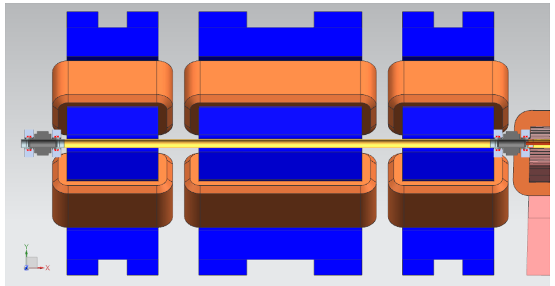


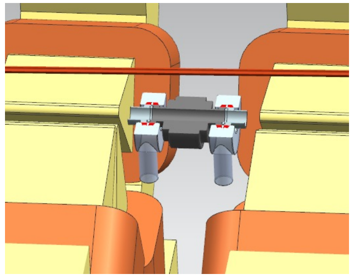


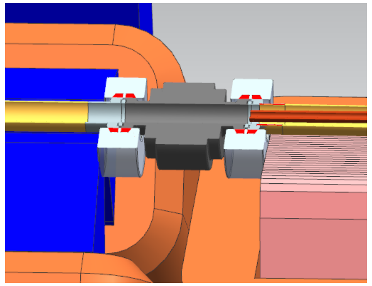
Magnets

and

Vacuum components







Coils collision

and

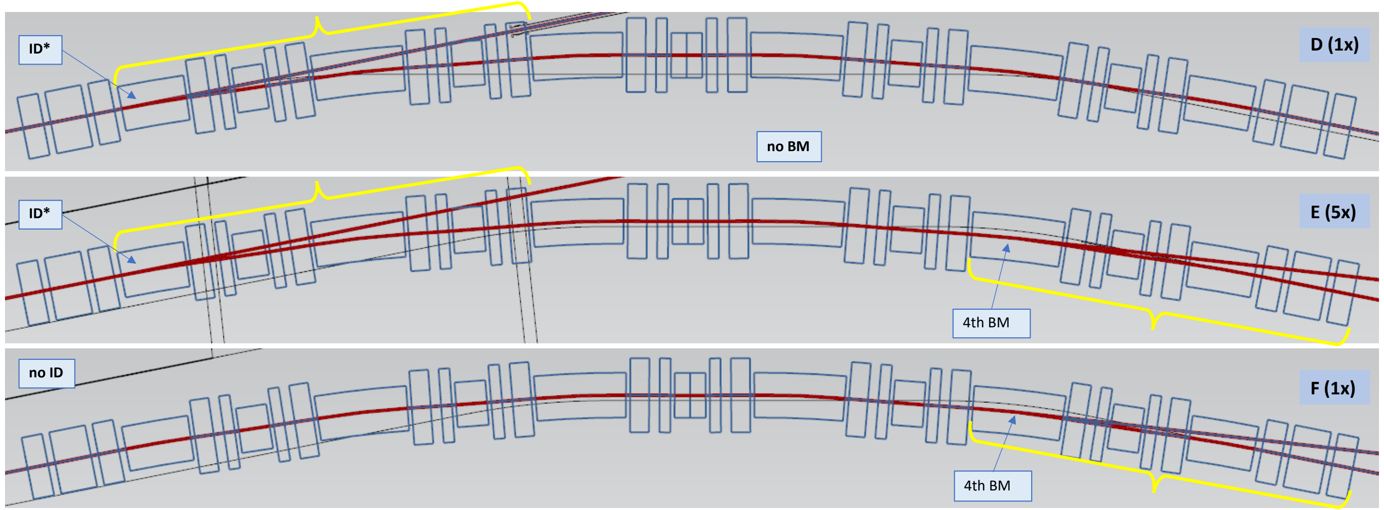
iron collision

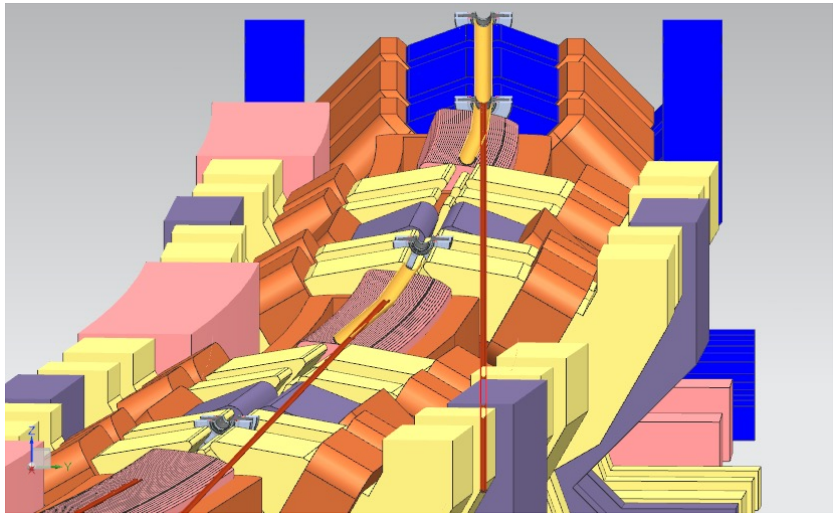
→ **On going optimization of the lattice, reducing the magnets length and increasing magnet to magnet distance.**

ALBA 01
Ayuda ICTS-MRR-2021-02-CELLS financiada por:
Plan de Recuperación, Transformación y Resiliencia
Financiado por la Unión Europea
NextGenerationEU

Beamline extraction

Lattice #	SS (before)	BL		BM (which dipole)	BL		Lattice type
Lattice 1	Injection	-	-	1st	BL01	MIRAS	Type A
Lattice 2	Free	BL02	Free	1st	BL03	Free	Type B
Lattice 3	Superconducting Wiggler SCW30	BL04	MSPD	1st	BL05	Free	Type B
Lattice 4	In-vacuum undulator IVU19	BL06	XAIRA	2nd	BL07	Free	Type C
Lattice 5	Free	BL08	Free	1st	BL09	MISTRAL	Type B
Lattice 6	In-vacuum undulator IVU21	BL11	NCD	-	-	-	Type D
Lattice 7	In-vacuum undulator IVU21	BL13	XALOC	2nd	BL14	Free	Type C
Lattice 8	Free	BL15	Free (3Sbar)	2nd	BL16	NOTOS	Type C
Lattice 9	RF	BL17	Pinhole3	4th	BL19	Free	Type E
Lattice 10	APPLE II helical undulator	BL20	LOREA	4th	BL21	Pinhole2	Type E
Lattice 11	Multipole Wiggler	BL22	CLAESS	2nd	BL23	Free	Type C
Lattice 12	APPLE II helical undulator	BL24	CIRCE	2nd	BL25	MINERVA	Type C
Lattice 13	RF	-	-	4th	BL28	Free	Type F
Lattice 14	APPLE II undulator	BL29	BOREAS	4th	BL30	Free	Type E
Lattice 15	Multipole Wiggler (5 poles in-vacuum)	BL31	FAXTOR	4th	BL32	Free	Type E
Lattice 16	Free	BL33	Free	4th	BL34	Pinhole1 and Xanadu	Type E





Beamline extraction
1st sextupoles of a cell are the most critical component

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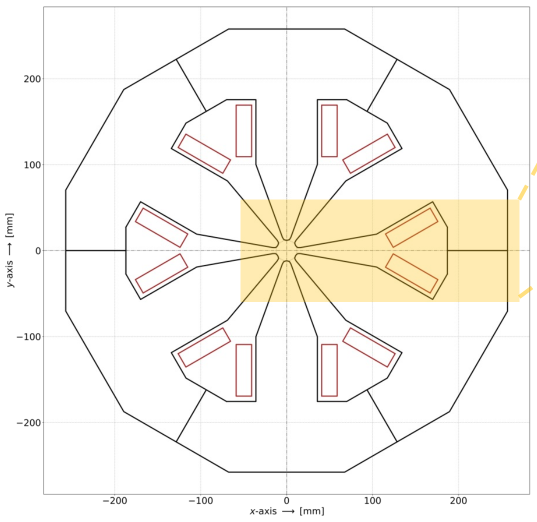
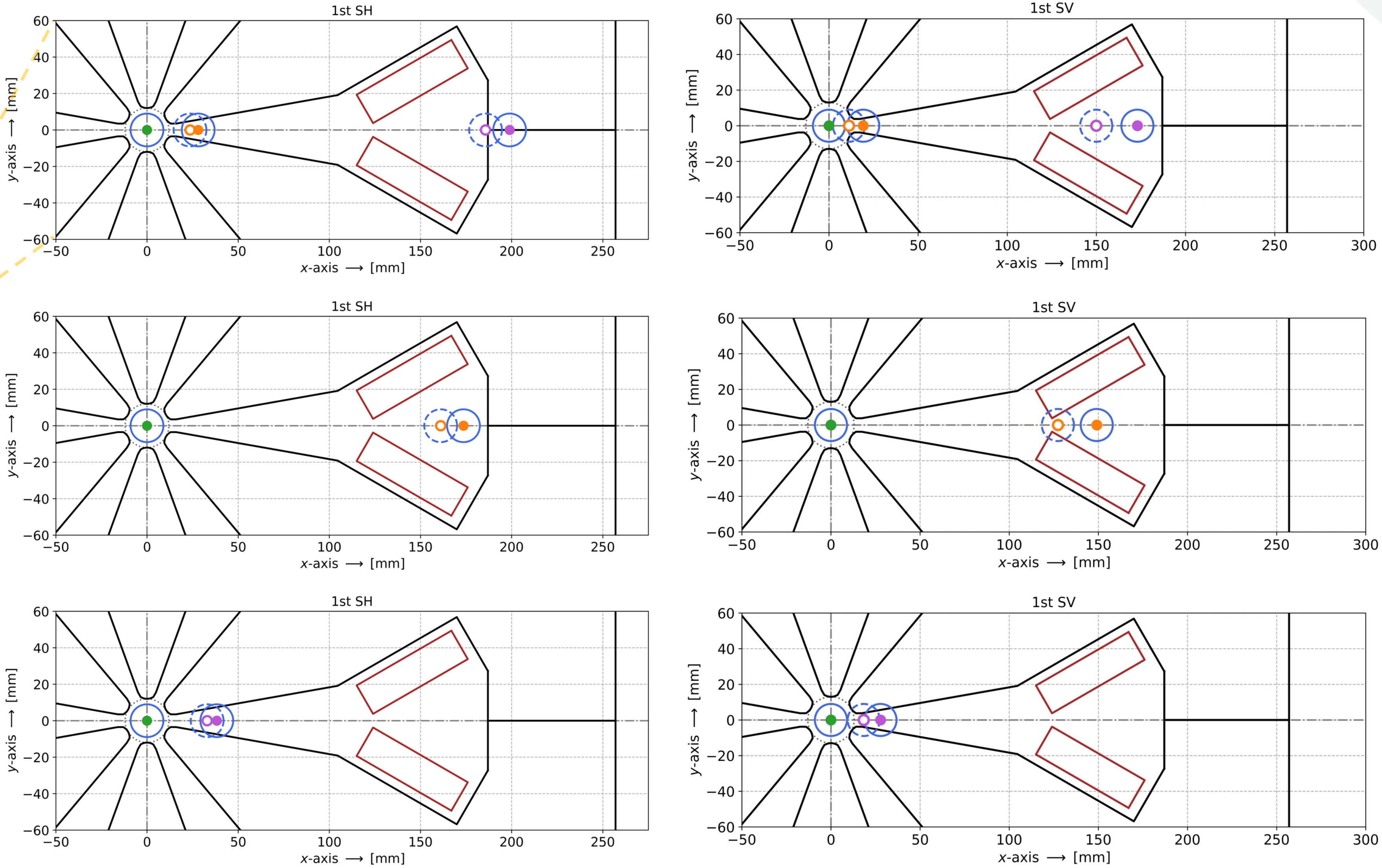
NextGenerationEU



Aperture = 24 mm

- Vacuum chamber (Entrance)
- Vacuum chamber (Exit)
- Electron beam
- Photon beam from ID (Entrance)
- Photon beam from ID (Exit)
- Photon beam from BM (Entrance)
- Photon beam from BM (Exit)



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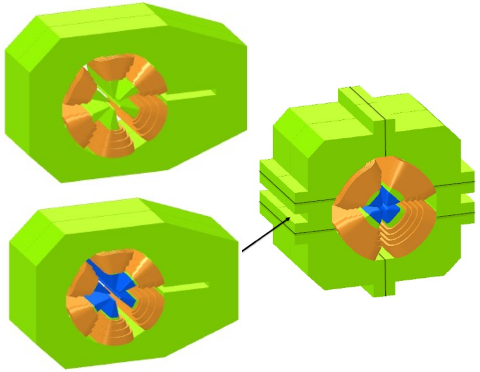
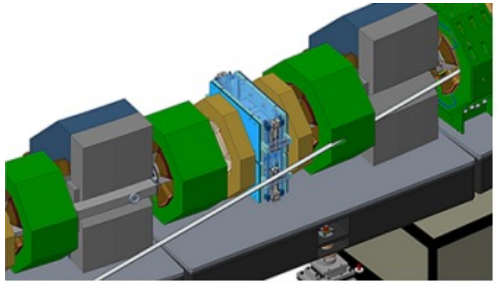
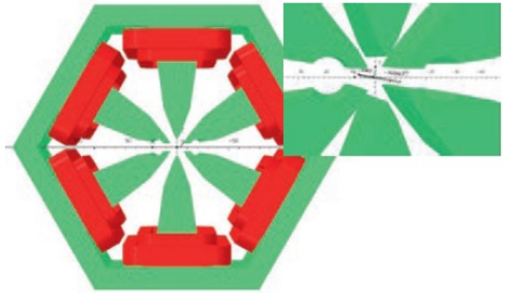
Beamline extraction



APS-U



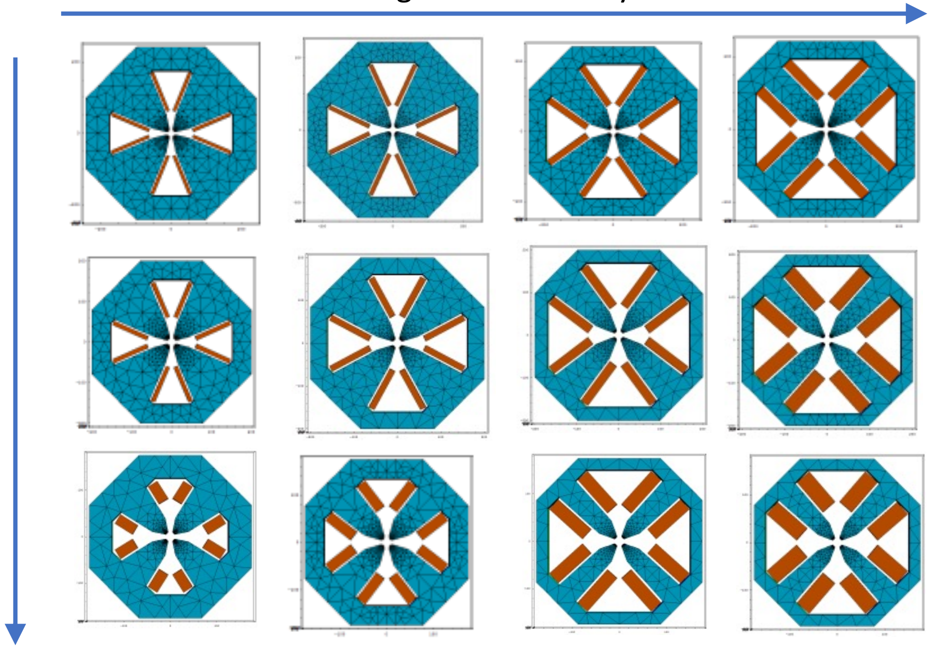
ALS-U



SOLEIL

Decreasing current density

Decreasing transversal dimensions



Iterations on going:

- Specific design of the magnets
- Magnets optimization procedures
- Optimization of the lattice to reduce/suppress the strength of the 1st sextupoles.

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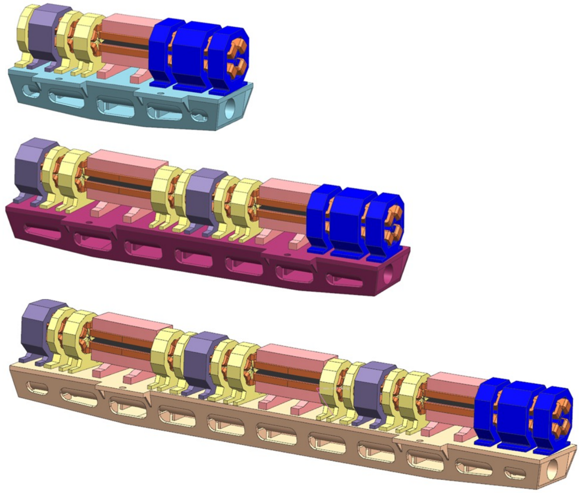
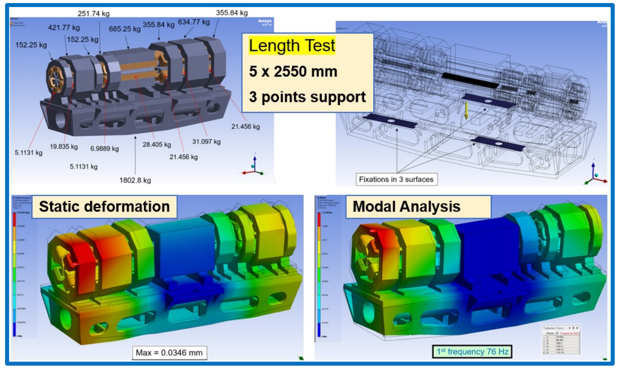
Ongoing Designs & Simulations

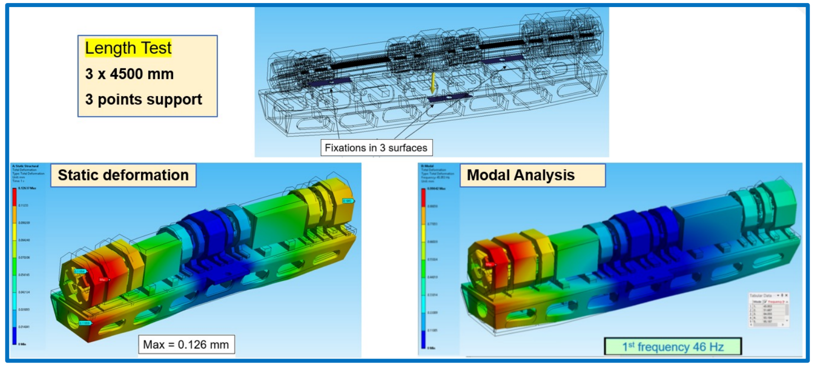
Results so far form First Simulations Round

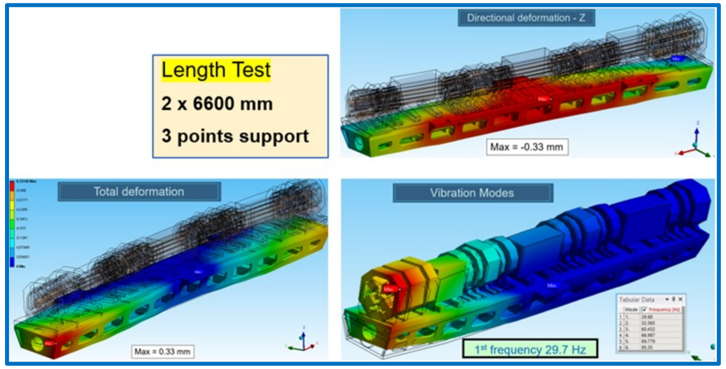
Girder Length options



Rank	Girder Model	Weight [kg]	Deformation [µm]	1st Eigenmode [Hz]
1st	**5 x 2550** - 3p - sym	5.286	34	76
2nd	**3 x 4500** - 3p - sym	8.780	126	46
3rd	**2 x 4500** - 3p - sym	12.552	330	29







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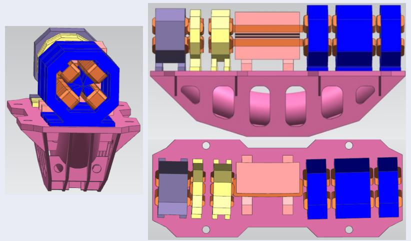
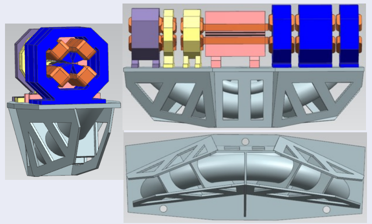
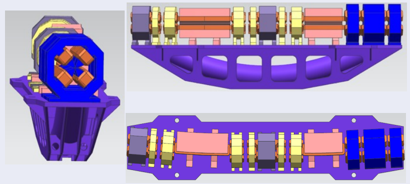
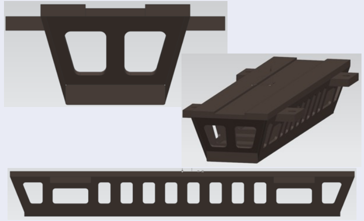
Girders

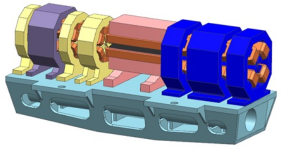
Girder Frame options

	4p – symmetric		3p – asymmetric	
2.5 m	Curved tube 	No tube *In Design*	Curved tube 	No tube *In Design*
4.5 m	Curved tube 	No tube 	Curved tube *In Design*	No tube *In Design*

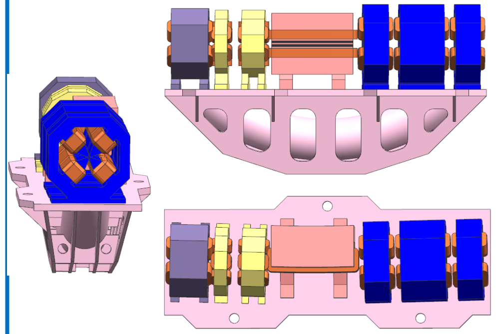
Variables:
- Geometry (tube/no tube)
- Length (2,5 / 4,5)
- Nº supports (3p / 4p)
- Symmetry (Sym / Assym)

Winner First Round
Tube - 2.5m - 3p – sym

34 µm
76 Hz



In FEA progress
Curved Tube - 2.5m - 3p - sym



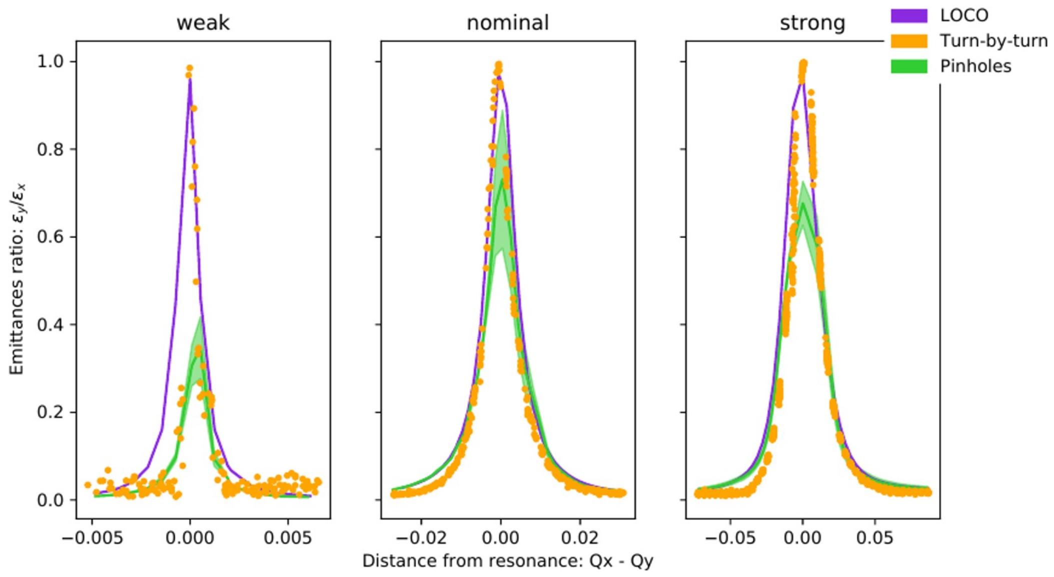
Ongoing Designs & Simulations

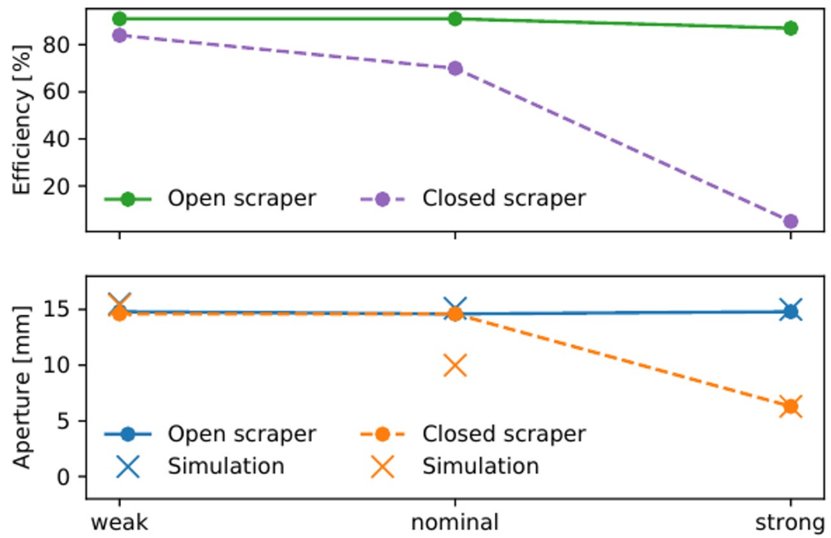
Results so far form First Simulations Round

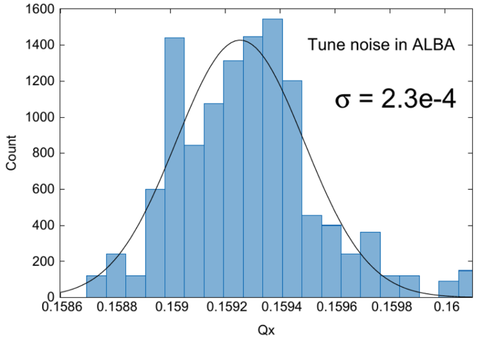
Contents

Full Coupling operation tests at ALBA

ALBA set in full coupling configuration → **Injection and operation feasible**



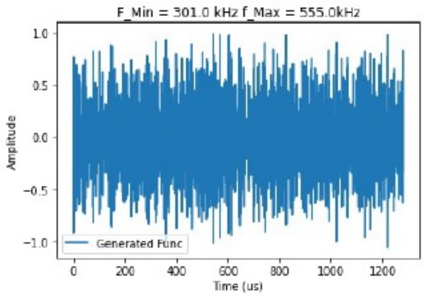


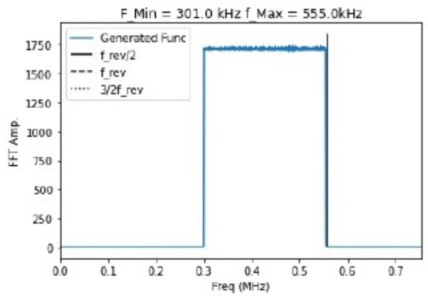


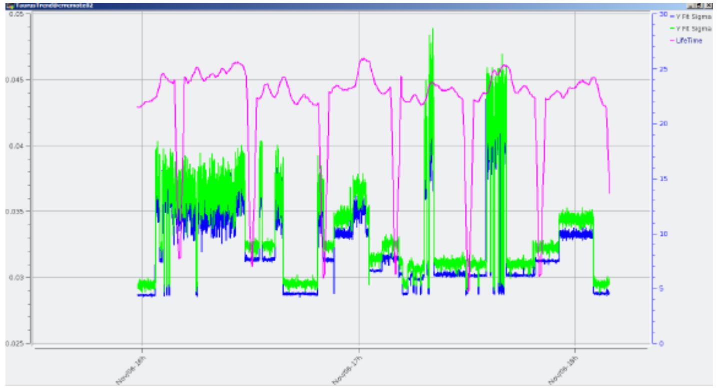
But other alternatives are being tested in order to increase the lifetime…

White noise excitation

Similarly as EBS-ESRF is doing: Vertically excite the beam with a wide-band noise amplifier
Tested at ALBA with Stripline + AFG whote noise + RF Amplifier







	σ_y (um)	RMS(σ_y) (um)	Life Time (h)
No Exc.	28.7	0.06	21
Exc. fmin=301kHz Fmax=556kHz	33.2	0.2	23.5
Exc. fmin=1673kHz fmax=5575	30.5	0.06	23
Exc. fmin=2231kHz Fmax=11151kHz	30.1	0.06	23

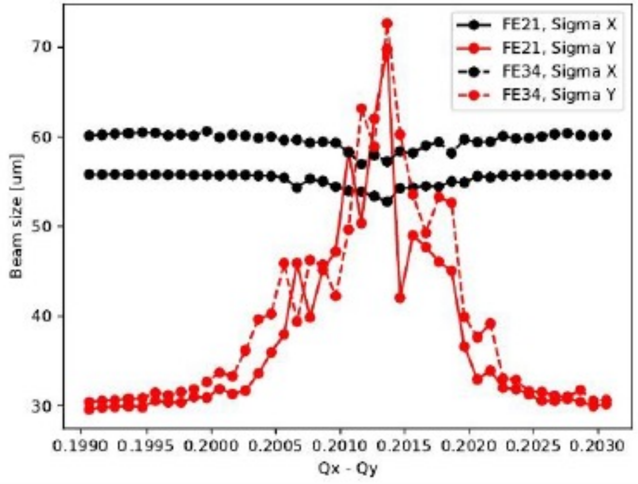
Vertical Beam size increase stably by 5%

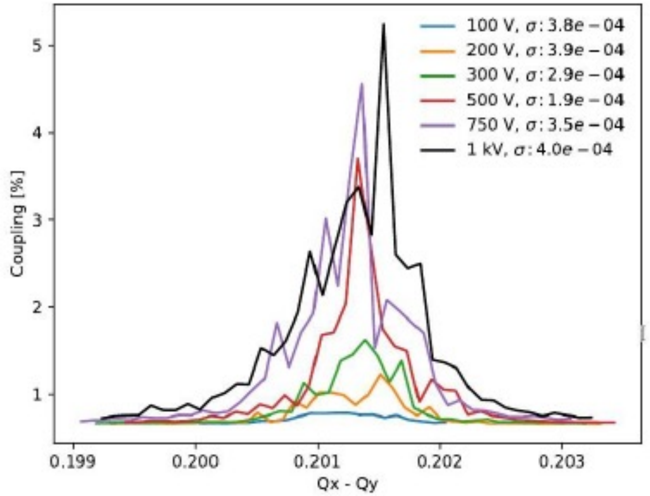
Feasible, but it requires more stable & stronger excitation.

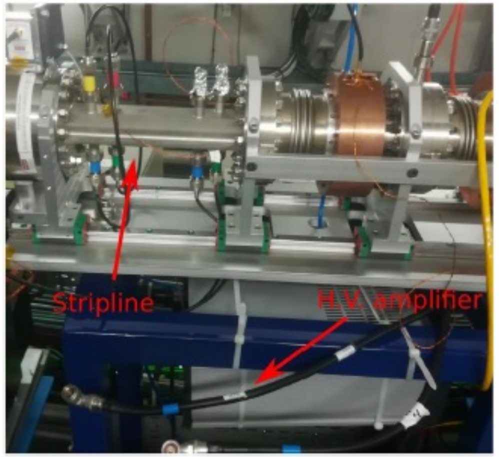
Con: It degradates the effective emmittance

AC Skew excitation (Qx-Qy)

Proposed by Peter Kueske at Bessy II
Tested at ALBA with Stripline + AFG Sinus excitation at Qx-Qy=230kHz + RF & Voltage Amplifier





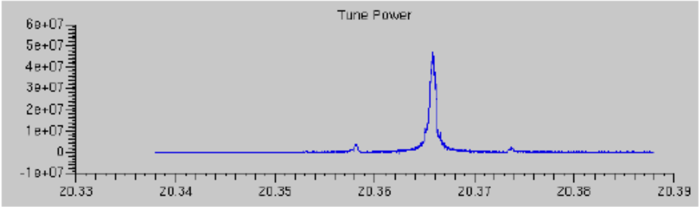


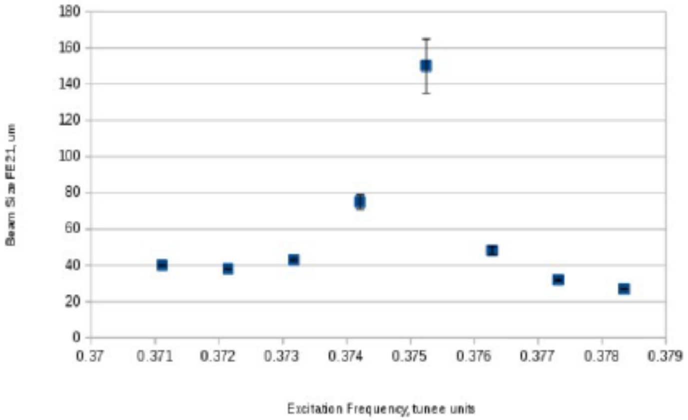
Created a 7% couplig

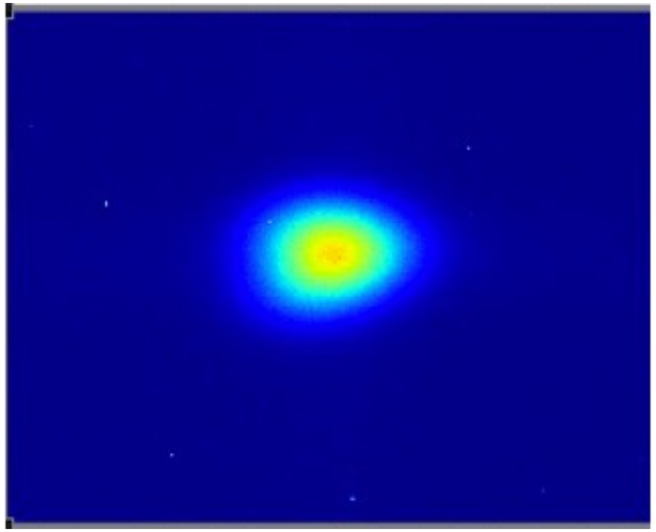
Feasible, but it requires stronger excitation and cope with tune jitter.
Adv: It does not degradates the effective emmittance, it is still a coupling mechanism

Synchrotron tune excitation (Qy+/-Qsyn)

Tested at other labs.
Tested at ALBA with Stripline + AFG Sinus excitation at Qy+Qsyn= 0,375Qy + RF Amplifier







Vertical Beam size increase stably by a factor 4.

Feasible, very efficient.

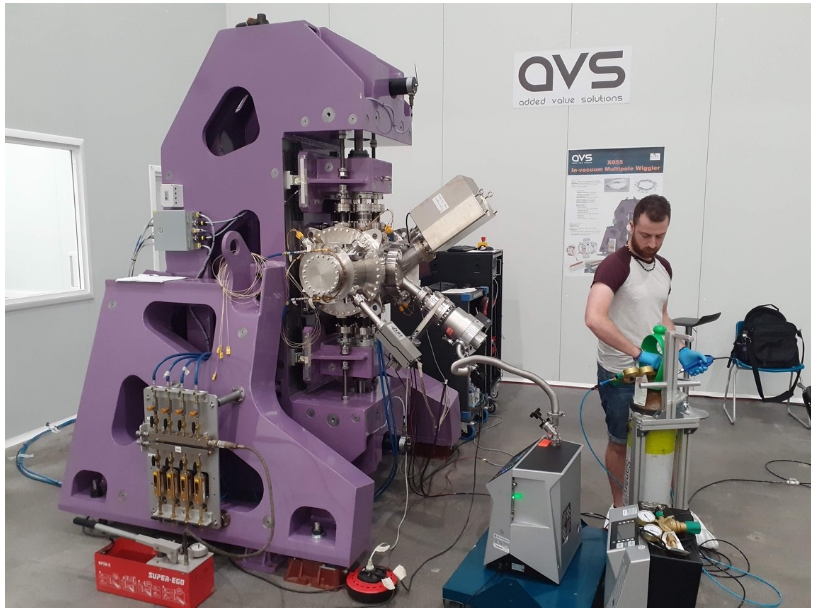
Con: It degrades the effective emmittance

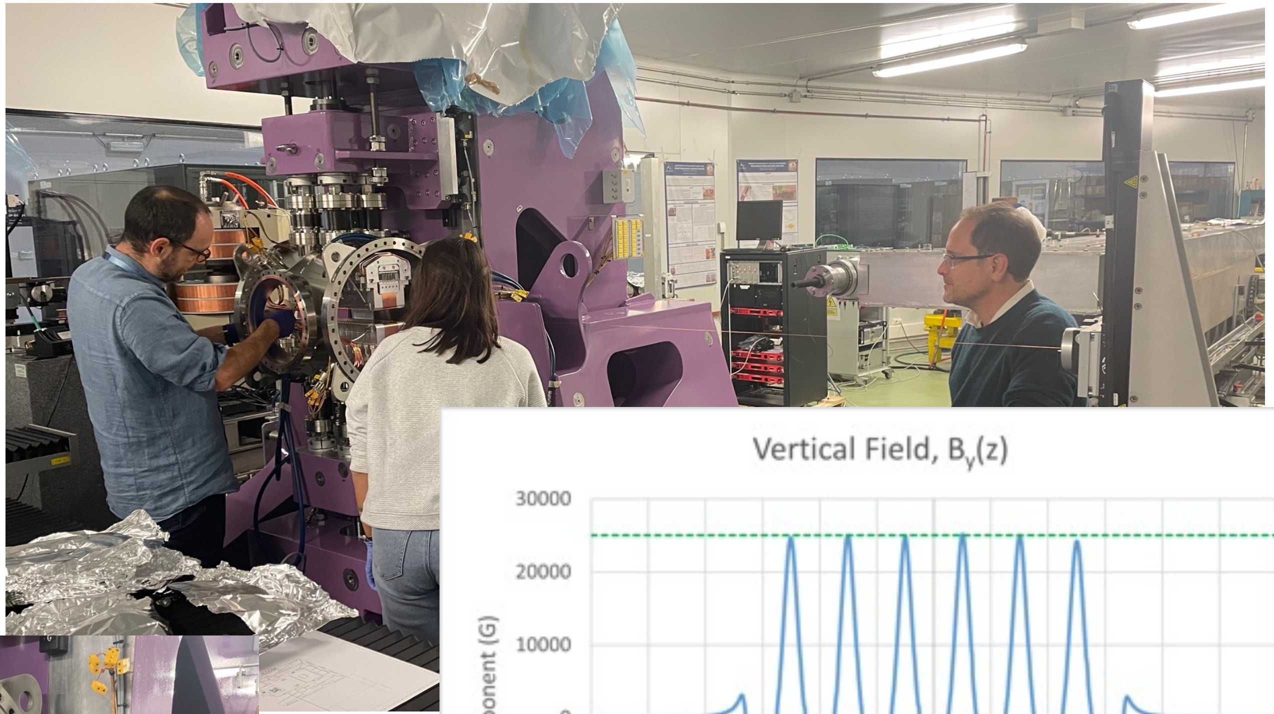
Contents

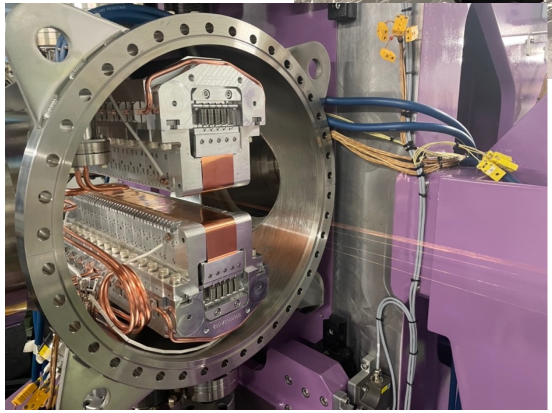
ALBA

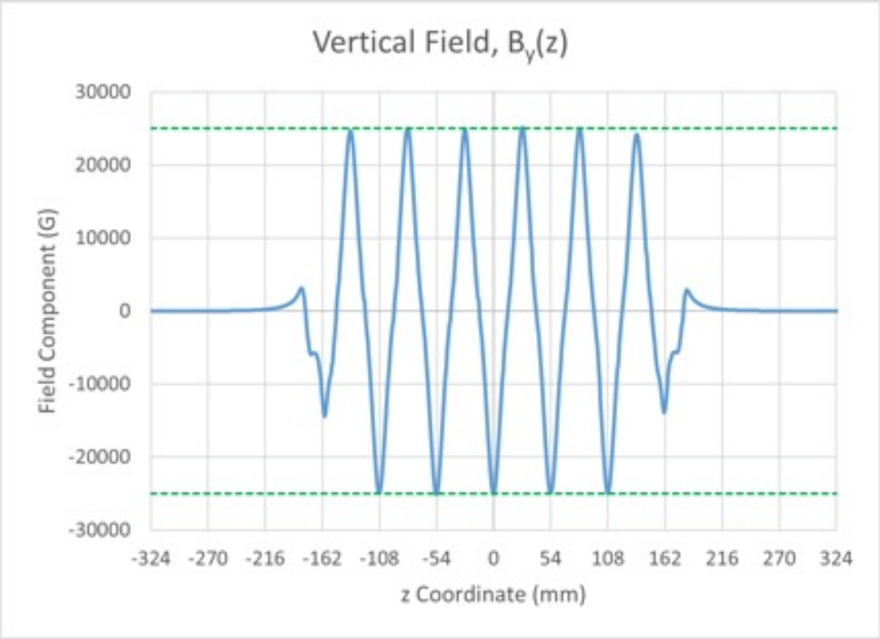
2.5 T FaXToR In Vacuum Wiggler Installation in Dec'22

Generalitat de Catalunya
Departament d'Empresa i Coneixement
UNIÓN EUROPEA
Fondo Europeo de Desarrollo Regional
"Una manera de hacer Europa"

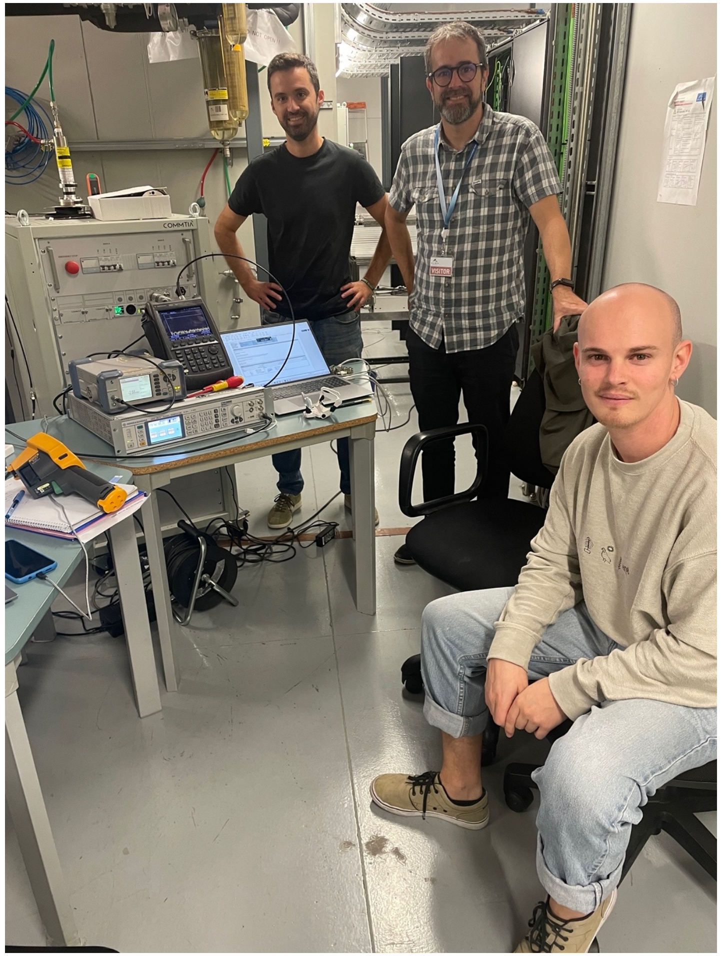








ALBA 1.5GHz SSPA Prototype
SAT done at RF Lab



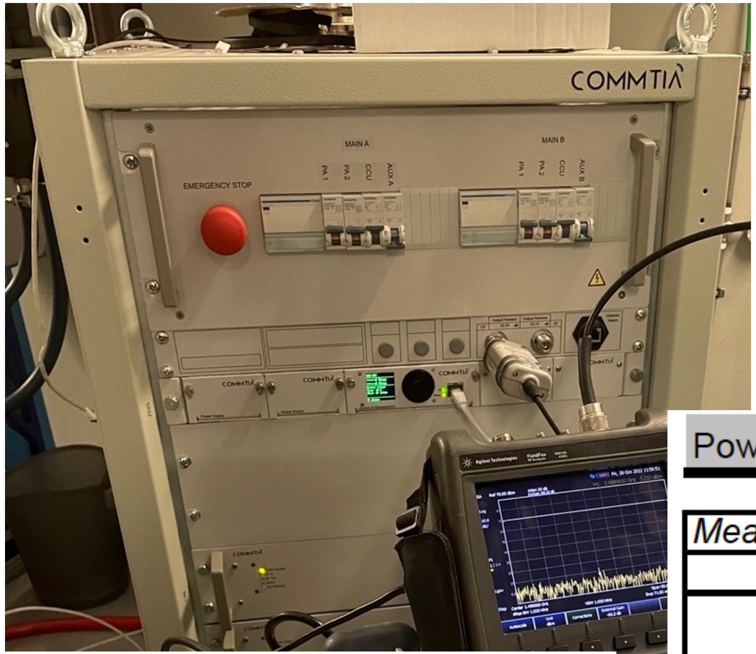
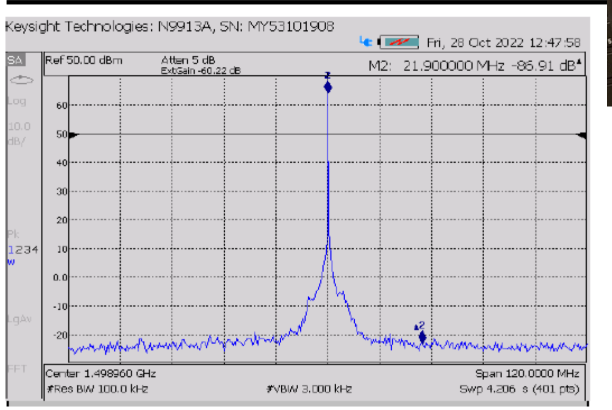


FIGURE 1.1 (Spectrum)



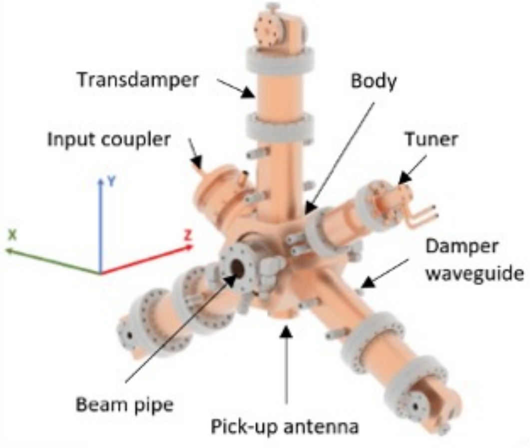
The **prototype construction** was co-funded by ALBA and the European Regional Development Fund (ERDF) within the Framework of the Smart Growth Operative Programme 2014-2020.

Power

Measure		*Value*
Output power	Pout dBm	65,5 dBm
Consumption	Pout W	7010 W
	Phase A	3520 W
	Phase B	3490,00
	Efficiency	50,6 %
Water flow	input flow	28,1 lpm
	output flow	27,7 lpm
	input temp	19,0 ºC
	output temp	20,0 ºC

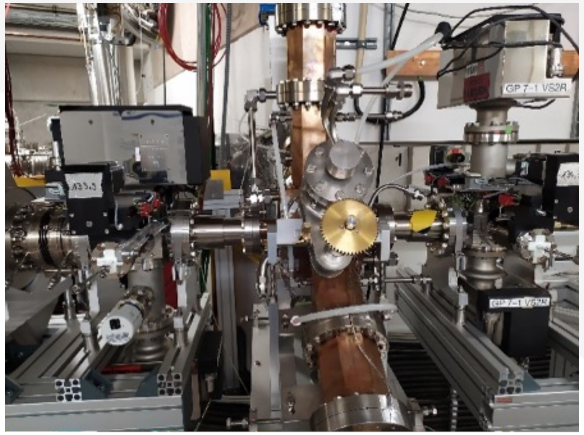
GaN Technology

ALBA 3rd Harmonic EU Active Cavity



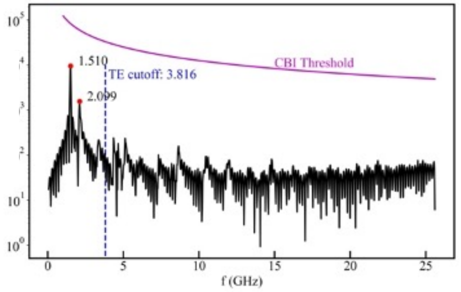
Designed by ALBA

Prototyped by ALBA

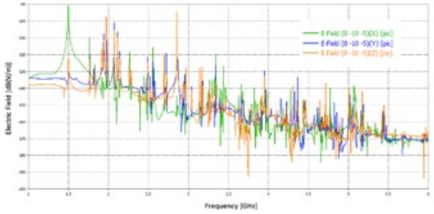


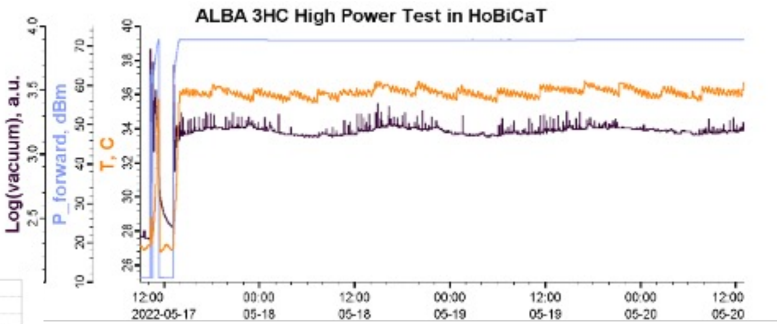
Installed at BESSY II

HOM damped



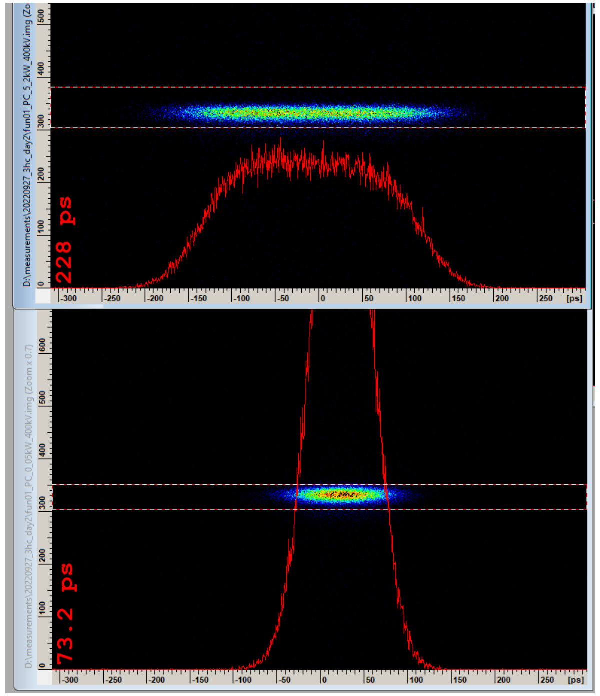
Bead pull measured

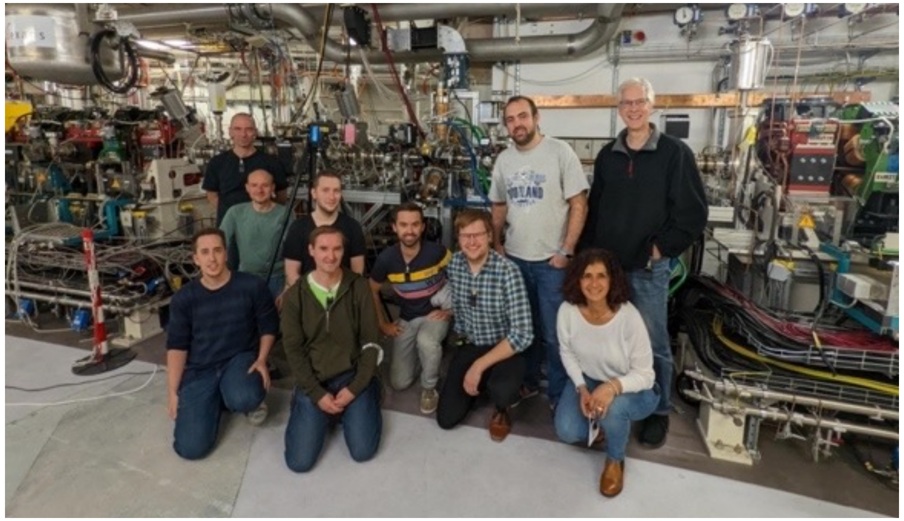


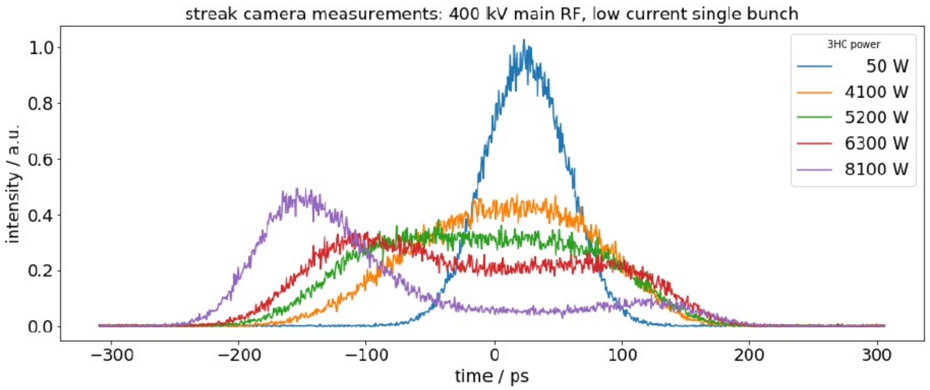


Power capable
12.5 kW for 3 days

ALBA 3rd Harmonic EU Active Cavity sucessfully tested at Bessy II







The **prototype design** was co-funded by ALBA and the CERN through the collaboration agreement KE2715/BE/CLIC for the Development of CLIC Damping Ring Technologies (2015-2018).

The **prototype construction** was co-funded by ALBA and the European Regional Development Fund (ERDF) within the Framework of the Smart Growth Operative Programme 2014-2020.

The **prototype tests** were co-funded by ALBA, HZB and DESY through the collaboration agreement RCN-CIN202100124 (2020-2023).

Full span of bunch lengthening achieved

26^{th} Sept 2022: Bunch lengthening single bunch 0.3mA

(only possible with active cavity)

ALBA

On behalf of the whole ALBA Team

Thanks!

ESLS Workshop,
December 14th, 2022