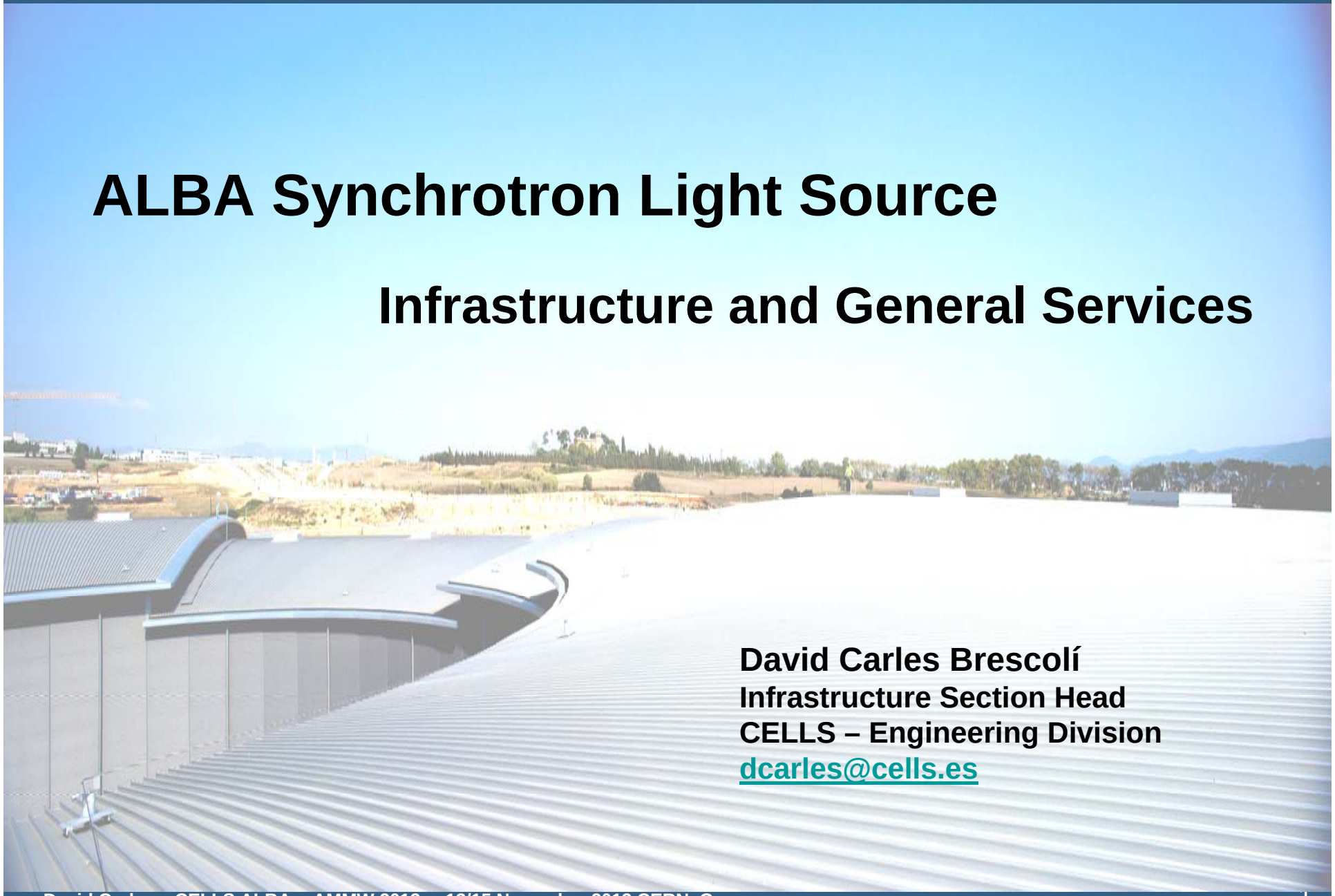
ALBA Synchrotron Light Source

Infrastructure and General Services



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Agenda

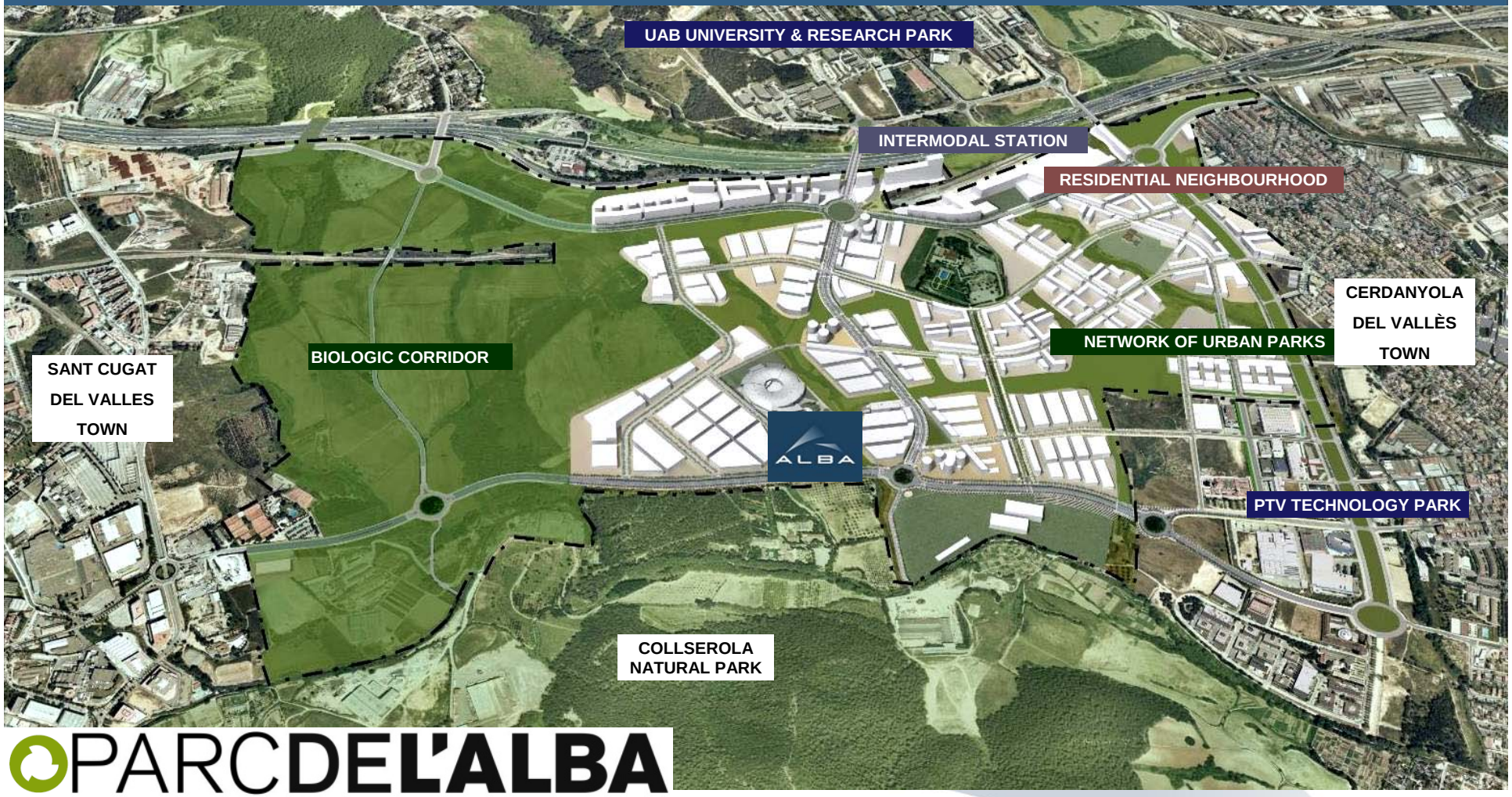
1. Introduction of ALBA Synchrotron Light Source
2. Main facts and figures of the ALBA Infrastructures

Where we are…

We are at…


Mediterranean sea
AIRPORT (25 min)
BARCELONA (20 min)
PARCDEL'ALBA
ALBA

www.parcdelalba.cat



PARCDEL'ALBA

340 ha	**180 ha**	**1.9 Mm^2**	**1.3 Mm^2**	**3,500**
TOTAL SURFACE	**GREEN AREAS**	**POTENTIAL FLOOR SPACE**	**PRODUCTIVE SPACE**	**HOUSING UNITS**
65% PUBLIC USE	25 ha FACILITIES	70% PRODUCTIVE	(40,000 WORKERS)	(10,000 RESIDENTS)
50% GREEN ZONES	0.1 Mm^2 COMMERCIAL SPACE	24% RESIDENTIAL	70% PUBLIC FLOOR SPACE	40% PUBLIC HOUSING

ALBA General Information

Facility/Laboratory: ALBA Synchrotron Light Source www.cells.es
Closest City/Town: Cerdanyola del Vallès - Barcelona
Country: Spain

ALBA is a facility co-financed by the Spanish government and the Catalan government.

ALBA is a circular-shaped machine, called a synchrotron, that uses arrays of magnets, called insertion devices to generate bright beams of synchrotron light. Around the machine there are a collection of experimental research laboratories, called beam lines. At each beam line, scientists independently use the light generated by the machine for a wide variety of experiments. The ALBA team currently consists of about 160 dedicated engineers, scientists, support staff and technicians.

ALBA History:

May 2006: Start building construction

April 2010: Inauguration of the facility

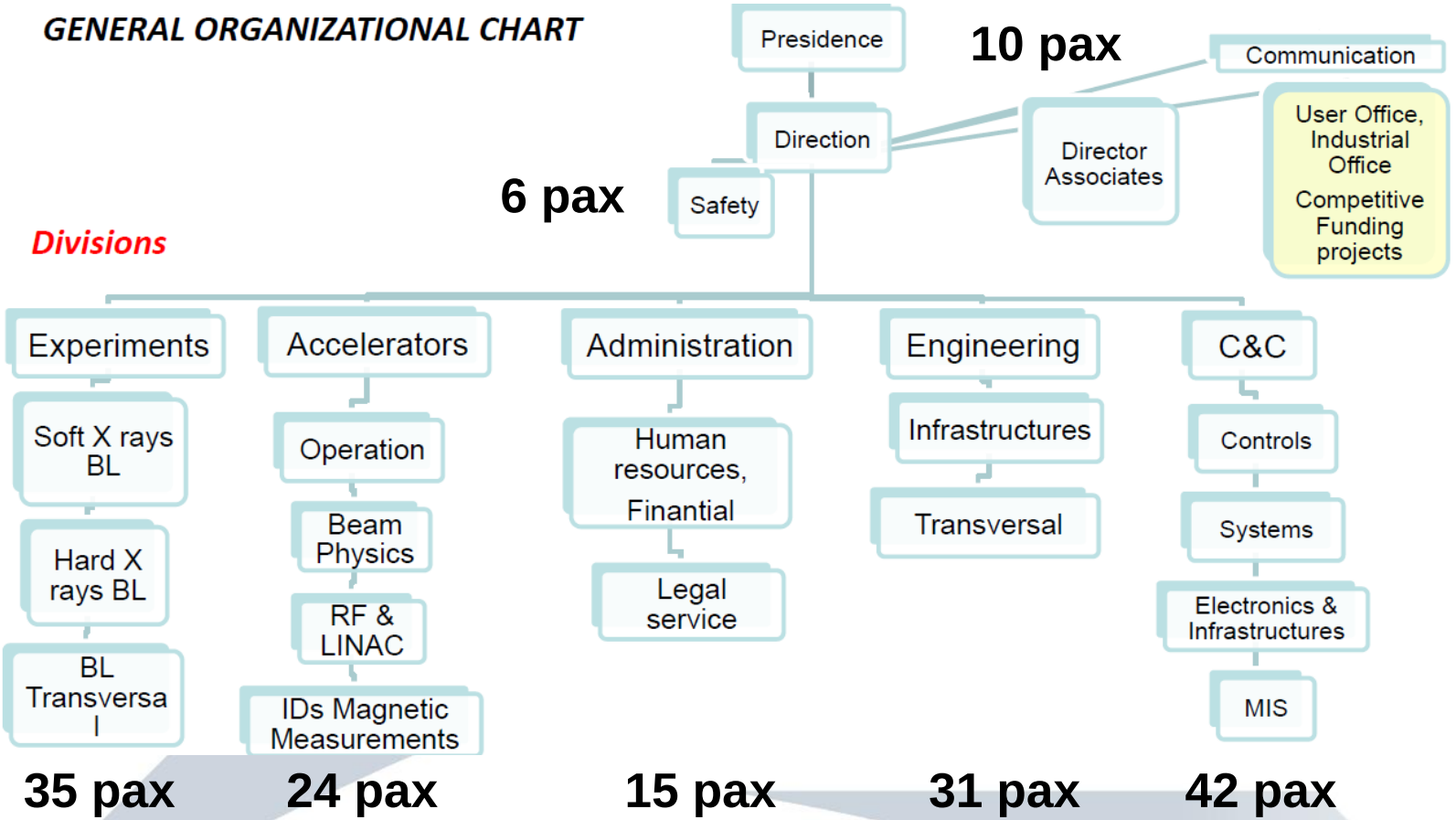
March 2011: Electron beam in the Storage Ring

Since May 2012, ALBA has been welcoming scientific users from all over the world

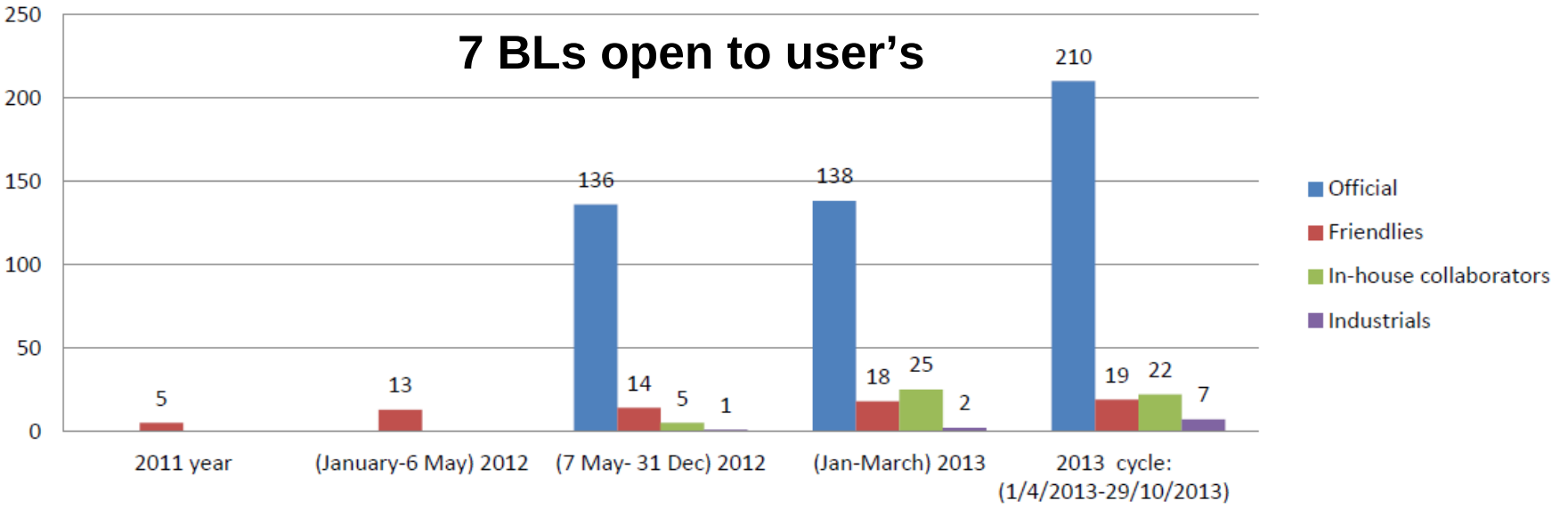
Total annual operation cost of the whole facility (€): 18,5 M€ / year

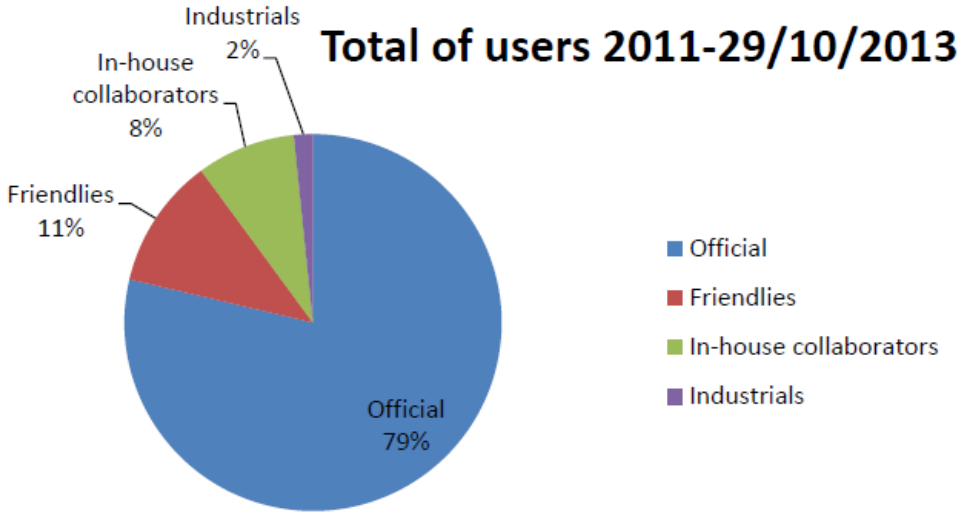
Part of the total annual operation costs that derives from energy related costs (€): 3,5 M€ / year

ALBA Who? Where?



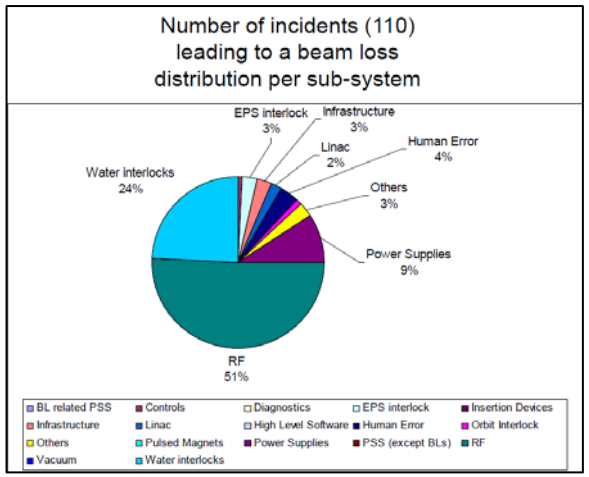
ALBA User's numbers





Since May 2012, ALBA has been welcoming scientific users from all over the world

ALBA machine operation 2013

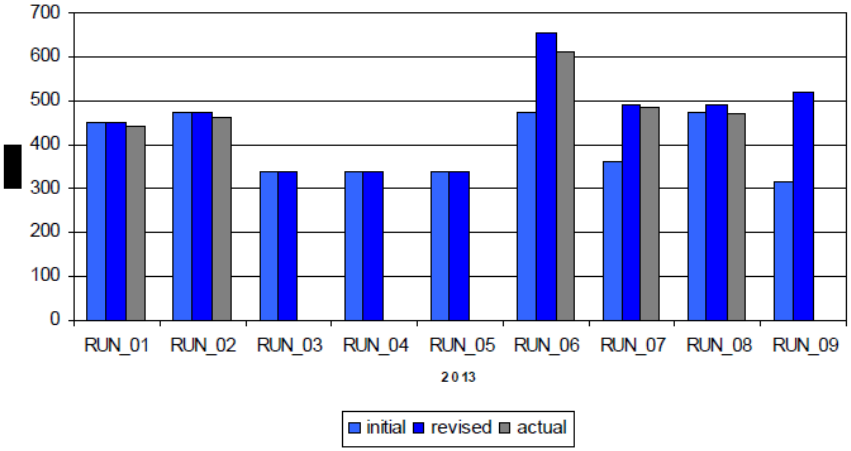


Beamline operation:

3355 h Scheduled January

4090 h Re-scheduled July

2471 h Delivered up to Run_08 (today)



ALBA Operations Calendar, January 2013-December 2013

BL operation	BL BL users and commissioning
Start-up	M Start up of accelerators with beam
Warm-up	W warm-up time Linac & RF & magnets & sub-systems optimisation
Shutdown	Off Civil Engineering, Accelerators and BL maintenance with no beam, installations and upgrades
Public & CELLS holiday	

Weekday	January Day	Week	Shift M	A	N	February Day	Week	Shift M	A	N	March Day	Week	Shift M	A	N	April Day	Week	Shift M	A	N	May Day	Week	Shift M	A	N	June Day	Week	Shift M	A	N	July Day	Week	Shift M	A	N	August Day	Week	Shift M	A	N	September Day	Week	Shift M	A	N	October Day	Week	Shift M	A	N	November Day	Week	Shift M	A	N	December Day	Week	Shift M	A	N
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Tu	1		Off	Off	Off											2		W	W	W						2		W	W	W			bl	bl	bl											1		BL	BL	BL										
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Th	3		W	W	W											4		W	W	W	2		W	W	W	4		W	W	W			BL	BL	BL	1		Off	Off	Off						3		BL	BL	BL										
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Tu	8		W	W	W	5		BL	BL	BL	5		BL	BL	BL	9		W	W	W	7		W	W	W	4		W	W	W	9		BL	BL	BL	6		Off	Off	Off	3		W	W	W	8		bl	bl	bl	5		BL	BL	BL	3		BL	BL	BL
We	9		W	W	W	6		BL	BL	BL	6		BL	BL	BL	10		W	W	W	8		W	W	W	5		W	W	W	10		BL	BL	BL	7		Off	Off	Off	4		M	M	M	9		W	W	W	6		BL	BL	BL	4		BL	BL	BL
Th	10		W	W	W	7		BL	BL	BL	7		BL	BL	BL	11		W	W	W	9		W	W	W	6		W	W	W	11		BL	BL	BL	8		Off	Off	Off	5		M	M	M	10		W	W	W	7		BL	BL	BL	5		BL	BL	BL
Fr	11		W	W	W	8		BL	BL	BL	8		BL	BL	BL	12		W	W	W	10		W	W	W	7		W	W	W	12		BL	BL	BL	9		Off	Off	Off	6		M	M	M	11		W	W	W	8		BL	BL	BL	6		bl	bl	bl
Sa	12		W	W	W	9		BL	BL	BL	9		BL	BL	BL	13		W	W	W	11		W	W	W	8		W	W	W	13		BL	BL	BL	10		Off	Off	Off	7		M	M	M	12		W	W	W	9		M	M	M	7		bl	bl	bl
Su	13		W	W	W	10		BL	BL	BL	10		BL	BL	BL	14		W	W	W	12		W	W	W	9		W	W	W	14		BL	BL	BL	11		Off	Off	Off	8		M	M	M	13		W	W	W	10		M	M	M	8		bl	bl	bl
Mo	14	3	M	M	M	11	7	M	M	M	11	11	M	M	M	15	16	W	W	W	13	20	W	W	W	10	24	W	W	W	15	29	M	M	M	12	33	Off	Off	Off	9	37	M	M	M	14	42	M	M	M	11	46	M	M	M	9	50	M	M	M
Tu	15		M	M	M	12		BL	BL	BL	12		BL	BL	BL	16		W	W	W	14		W	W	W	11		W	W	W	16		BL	BL	BL	13		Off	Off	Off	10		M	M	M	15		bl	bl	bl	12		M	M	M	10		bl	bl	bl
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Sa	26		BL	BL	BL	23		W	W	W	23		W	W	W	27		W	W	W	25		W	W	W	22		W	W	W	27		M	M	M	24		W	W	W	21		BL	BL	BL	26		BL	BL	BL	23		BL	BL	BL	21		Off	Off	Off
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ALBA operations calendar 2014

- 5500 h of operation for 2014, approx. 75% Beam for BLs and 25 % Machine development.
- Approximate operational pattern of ALBA over a typical year:
  - 5500 h of operation per year - Weekly runs with minimum of 5 days on a row for BLs.
  - One week of shutdown after 4 runs of BLs, after a short shut down (1 week), minimum of 2 days Machine.
  - 1 long shut down in August to do infrastructure maintenance: cooling and electrical, after a long shut down, minimum of 3 days warm and 7 days for Machine

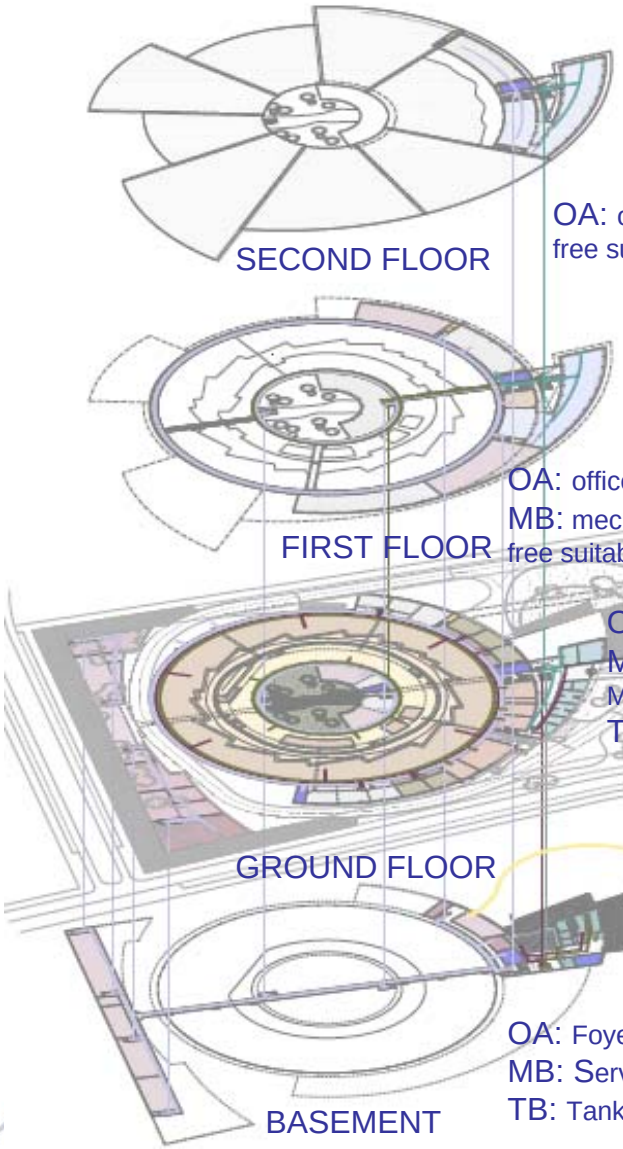
- **Shutdown periods are the best availability window to execute the critical scheduled maintenance joined to the improvements and upgrades of the whole facility.**

ALBA Maintenance target and strategy

- Objective, main target:
  - Maximum reliability at minimum cost.

- Strategy:
  - Keep in-house all knowledge necessary to operate and maintain the facility.
  - In-house management of the whole maintenance of the facility.
  - Optimize the maintenance cost related to personnel, spares and reposition.

ALBA Buildings

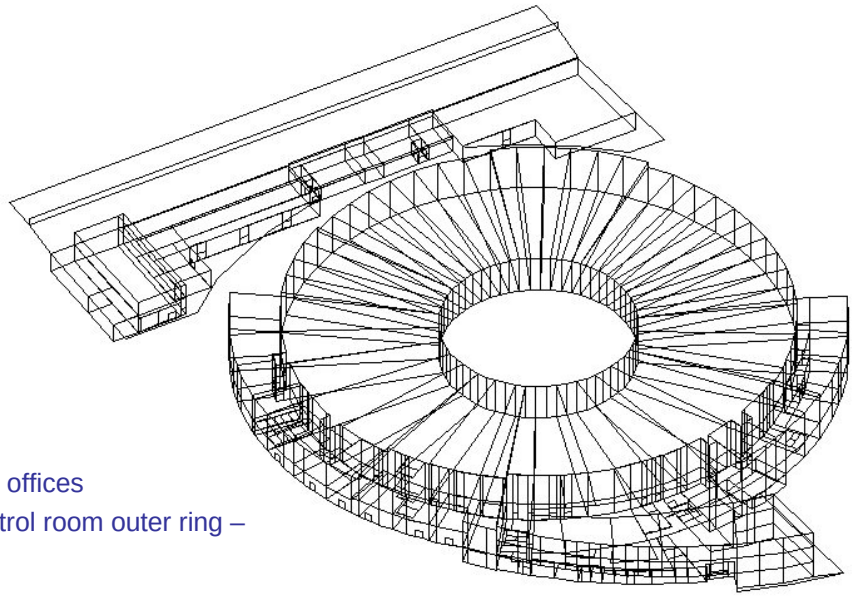


OA: offices
free suitable for offices

OA: offices – free suitable for offices
MB: mechanical rooms – control room outer ring –
free suitable central courtyard

OA: Entrance – offices - meeting and show rooms
MB: ALBA tunnel – Exp hall – Service area - Laboratories -
Mechanical rooms – loading area
TB: cooling & heating plant – workshops - storage

OA: Foyer – Auditorium – Cafeteria - Stores
MB: Service tunnel
TB: Tanks – Water Treatment – Dynamic UPS



ALBA Site: 61.185 m2
Experimental Hall: 14.000 m2
Offices & Labs: 11.746 m2
Technical building: 3.150 m2
Warehouse building: 2.000 m2

ALBA OUTDOOR Infrastructures

- ST1 SUB STATION CODONYERS: devoted transformer 220/25 KV
- ST4 POLYGENERATION POWER PLANT: exceptional quality and reliability of district heating and cooling supply.

Energetic triangle

ALBA IS DIRECTLY CONNECTED TO THE 220 KV HIGH VOLTAGE NET.

ST1 SUB STATION
CODONYERS 220/25 KV

THROUGH A 20 MVA DEVOTED TRANSFORMER, THE VOLTAGE IS REDUCED FROM 220 KV TO 25 KV, AND TRANSMITED TO ALBA.

2 X 25KV

1,8 Km.

2 X 25KV

1,8 Km.

ALBA

25KV

0,7 Km.

Cold water supply

DH&C

Hot water supply

11 DRY TYPE TRANSFORMERS

DIFFERENT POWERS (From 0,8 to 2 MVA)

AT ALBA, THE VOLTAGE IS FINALLY REDUCED FROM HIGH TO LOW VOLTAGE, FROM 25 KV TO 400 V.

ST4 COGENERATION PLANT

MOREOVER DHC SUPPLY, ALBA HAS 25 KV REDUNDANCY THROUGH THE COGENERATION PLANT ST4.

Electricity

Source of electricity:

Spain high voltage net, connected with a devoted transformer 220 / 25 KV of 20 MVA

In case of power supply failure, what are the backup alternatives available?

Taking into account the specific characteristics and the different needs for continuity of supply of the equipment that we feed, four (4) levels of continuity of the power supply are presents in the facility: non-preferential, preferential, critical and clean.

For preferential and critical loads, standby generators and UPS systems are ready and 24/365 availability.

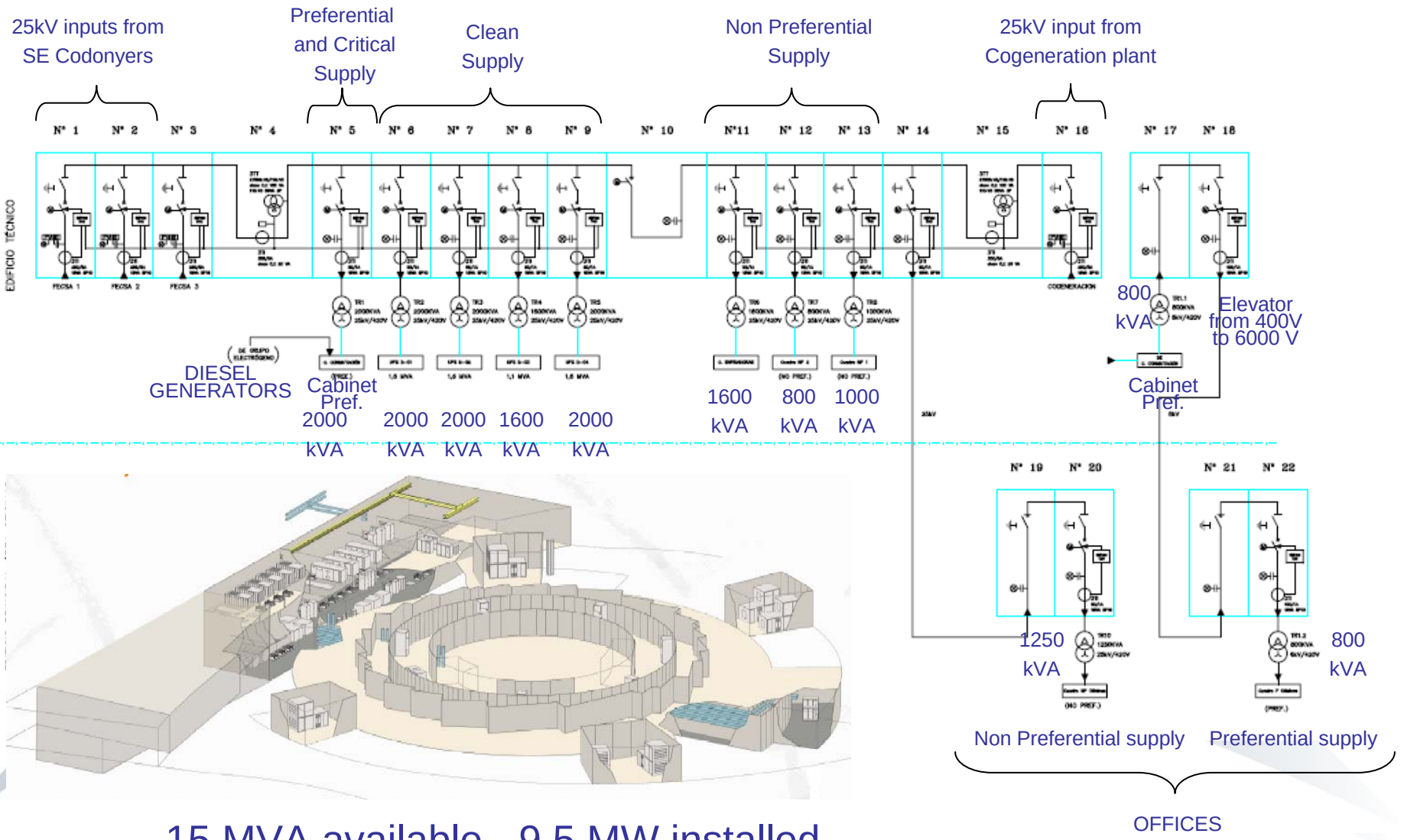
Beam power (MW): *2 MW*

Annual electricity consumption (*MWh*): *20.000 Mwh / year*

Electrical consumption pattern over a typical year on a monthly basis:

1.800 Mwh / month (shutdown August 1.000 Mwh)

High voltage scheme at ALBA



15 MVA available - 9,5 MW installed

Continuity levels for power supply

Taking into account the specific characteristics and the different needs for continuity of power supply of the equipment that we feed, up to four different levels are presents:

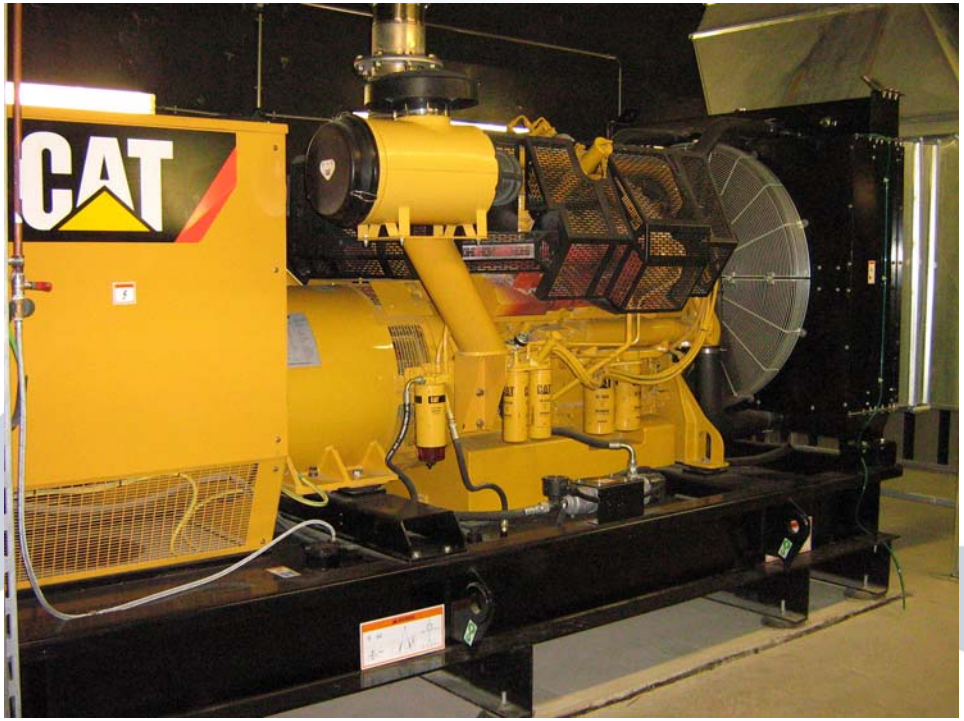
NON-PREFERENTIAL 4,6 MW	PREFERENTIAL 2 MW	CRITICAL 0,8 MW	CLEAN 7,6 MW
It feeds services that can remain interrupted during a long period of time, from a few minutes to several hours, like part of lighting, comfort air conditioned, office sockets, etc.	It feeds services that can with stand brief cuts, from a few seconds to some minutes.	The critical supply feed the services that cannot tolerate any interruption, it is done with local static UPS with an autonomy of hours and also recharged by centralized diesel generators.	Supplies those loads that need high quality supply. It means no micro power cuts accepted, and also free of disturbances such as drops, under - and over voltage, harmonics etc.

Preferential power supply

SUPPLIES THOSE LOADS THAT CAN SUPPORT SHORT POWER CUTS, UP TO 30 SECONDS.

SUPPLY THROUGH DIESEL GENERATORS.

USED FOR: lifts, hydraulic circuits, part of the lighting, etc.



2 Diesel generators at ALBA

Critical power supply

SUPPLIES THOSE LOADS THAT CAN NOT SUPPORT POWER CUTS.

SUPPLY COMPOSED BY DIESEL GENERATOR + STATIC UPS.

USED FOR: controls, vacuum, systems, EPS, PSS, Beam Lines, control room, data process center, etc.

+

Static UPS's supplied through diesel generators

Clean power supply

SUPPLIES THOSE LOADS THAT NEED HIGH QUALITY SUPPLY: It means no micro power cuts accepted, and also free of disturbances such as drops, under - and over voltage, harmonics etc.

SUPPLY FILTERED BY DYNAMIC UPS: fly wheel piller.

USED FOR ACCELERATOR EQUIPMENT: power supplies of magnets, RF plants or deionized chilled water pumps for cooling.

4 Dynamic UPS

Cooling

Annual average cooling requirements (*MWh*): *18.000 MWh / year*

Cooling power (*MW*): total needed of 6,2 MW at full operation

HVAC 3,2 MW + Process cooling 3 MW

Source of cooling: 2 different sources of cooling supply with full capacity each one.

internal - own production mode

external - coming from a closest cogeneration plant

ALBA Installed cooling capacity: in own production capacity of 8,4 MW divided into:

2 chillers (screw comp.) with each 1.3 MW = total 1 of 2.6 MW +

2 chillers (centrifugal comp.) with each 2.9 MW = total 2 of 5.8 MW

In case of cooling failure what are the backup alternatives available? Redundancy:

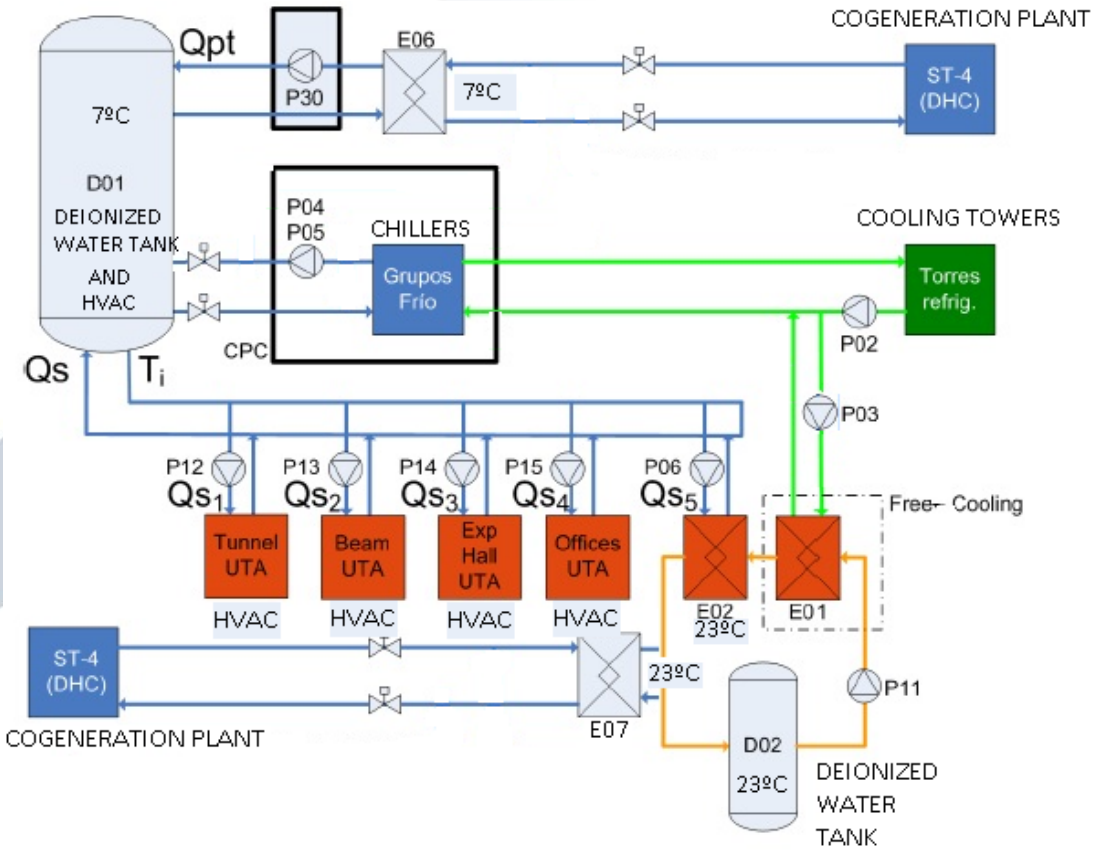
A small chiller breaks down -> 1.3MW +2 x 2.9MW = 7.1 MW > 6.2 MW

A big chiller breaks down -> 2 x 1.3MW + 2.9MW = 5.5 MW < 6.2 MW

Main energy diagram

THERE ARE THREE DIFFERENT CIRCUITS:

COOLING WATER, AT 7±05ºC, mainly for HVAC
HOT WATER, AT 50±1ºC, for comfort air conditioning
DEIONIZED WATER, AT 23±0.2ºC, devoted to cool scientific equipment



Chilled water

Cooling systems is made by 4 units of condensed water machines that produce chilled water at 7ºC

2 units are centrifugal compressors of 2,9 MW each and 2 mores units of screw compressors of 1,3 MW each

Total capacity cooling of 8,4 MW

Condensation of these machines has been made with 8 units of open cooling towers of 1,25 MW each

Water treatment

REQUERIMENTS:
Input temp of the DW circuit ALBA tunnel, 23 ± 0.2ºC.
Thermal loads to be dissipated by the water.
Pressure rates fixed.
Great purity, maximum conductivity of 0.20 μS/cm.
Filtered to 10 μ (micron)
Volume 200 m³ with 4 closed rings with common return.

SOLUTION: decalcified units plus reverse osmosis equipment. More ecological in regard to the residual water but big attention, maintenance and care of the membranes.
Characteristics parameters of the net, inlet water supply from the urbanization net in Barcelona.
Decalcified unit, maximum production of 27 m3/h.
Osmotic water production capacity of 2,5 m3/h.
2.000 lts/h flow for maintenance of membranes.

Air Conditioning accelerators tunnel

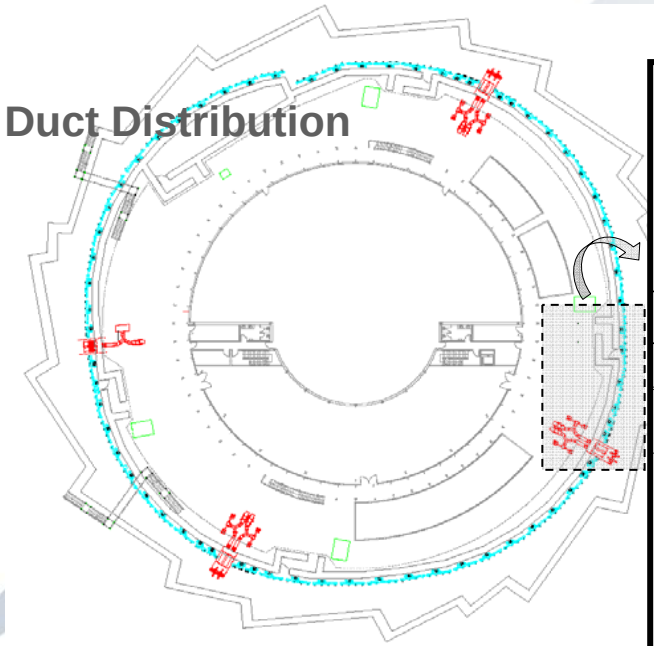
ALBA Tunnel: turbulent flow system

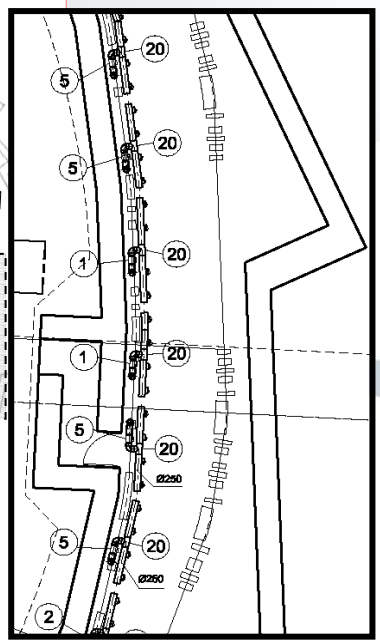
5 Air Treatment Units with cooling capacity of 200 Kw each

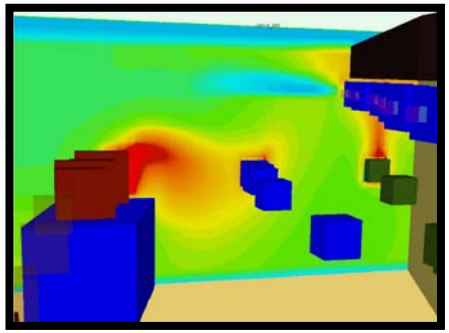
Total air flow of 68.000 m3/h

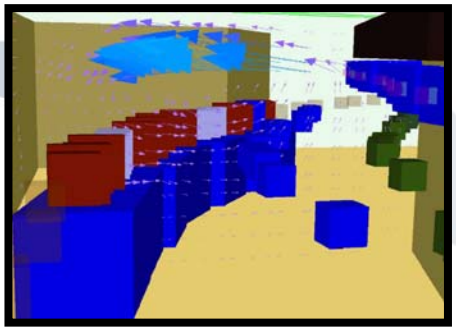
Average temperature 23ºC, variation Tmax-Tmin < 0'4ºC

Duct Distribution



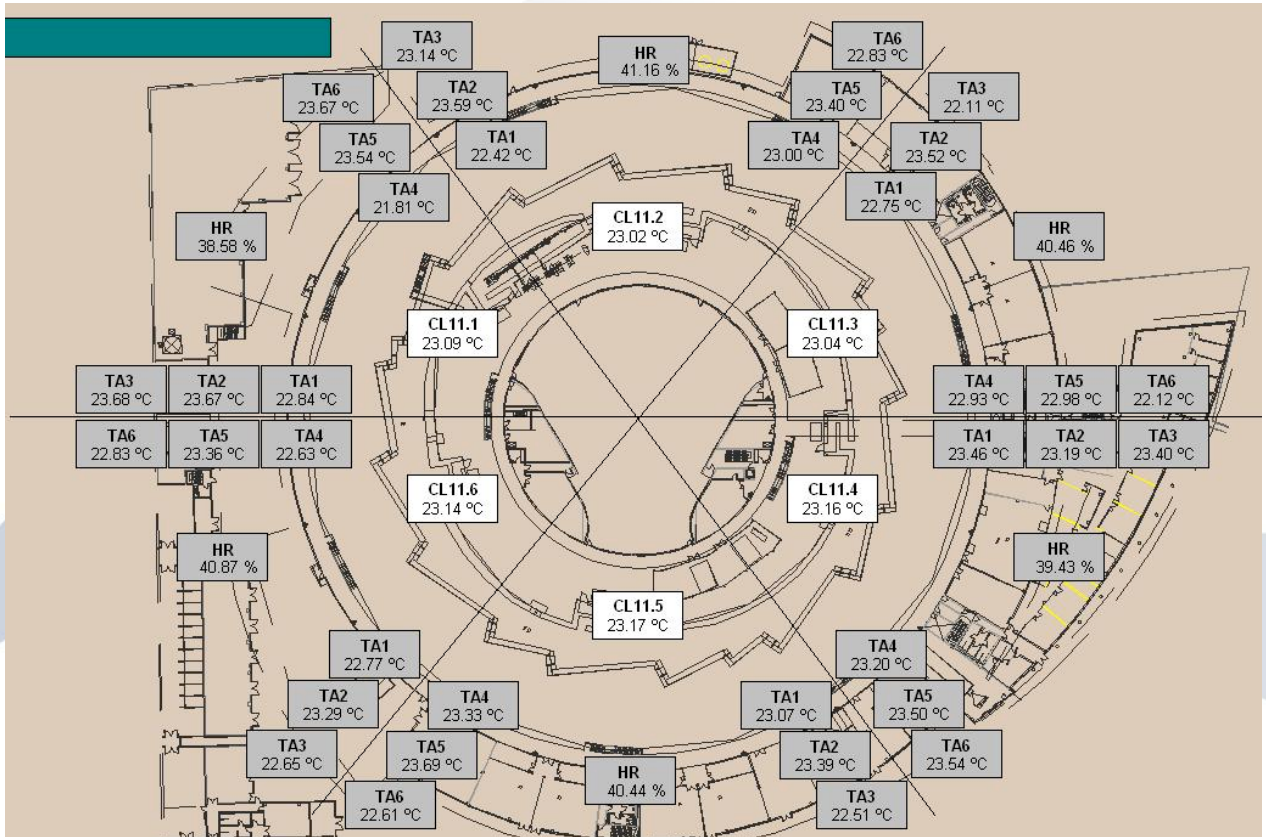






Air Conditioning Exp Hall

Hall Experimental: displacement flow system.
6 Air Treatment Units with cooling capacity of 1.160 Kw each and heating capacity of 450 Kw each.
Total air flow 240.000 m3/h
Equipped with free-cooling system and humidifier by spraying
Average temperature 23ºC, variation Tmax-Tmin < 2ºC



GTC architecture

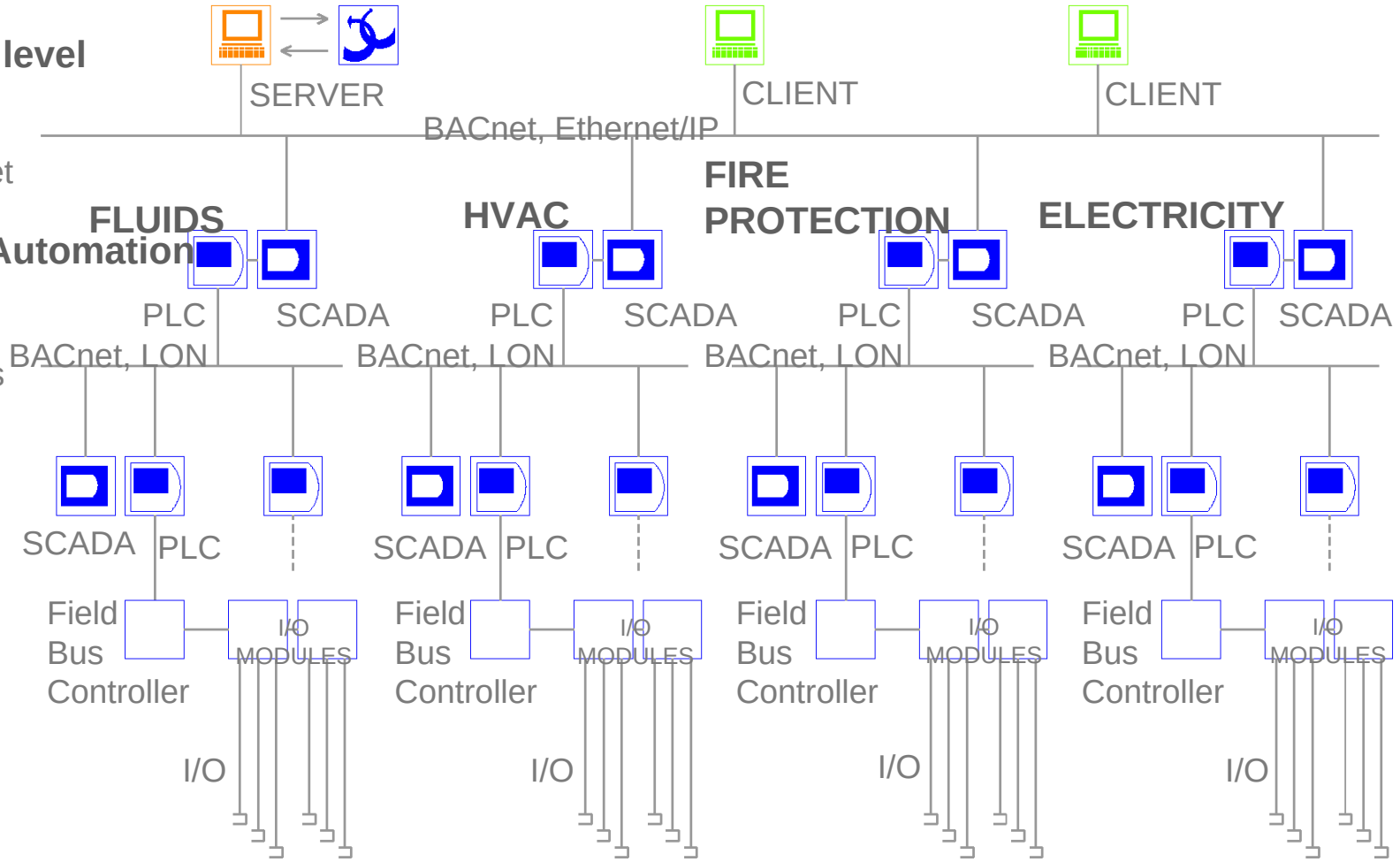
CENTRALIZED CONTROL SOFTWARE OF CONVENTIONAL FACILITIES

Management level
1. Server
2. Clients
3. Lan/Ethernet controllers

Global level Automation
1. PLC
2. SCADA
3. BACnet Bus
4. LON mark

Local level Automation

Field level
1. Values
2. Inverters
3. Sensors
4. Indicators



Thanks all!

David Carles on behalf of the whole ALBA Infrastructure Section:

We undertake and lead all necessary actions to ensure the ALBA conventional facilities are kept in a safe, stable and continuous manner, following operational and environment, health and safety procedures.