TOWARDS THE ALBA II

Oscar Matilla, Jose Avila-Abellan, Fulvio Becheri, Sergi Blanch-Torné (on leave), Albert Miret Burillo, Antonio Camps Gimenez, Isidre Costa, Guifre Cuni, Toni Fernández Maltas, Roberto Homs, Jairo Moldes, Emilio Morales, Carlos Pascual-Izarra (on leave), Antoni Pérez Font, Sergi Pusó Gallart, Zbigniew Reszela, Borja Revuelta (on leave), Alberto Rubio, Sergi Rubio Manrique, Jordi Salabert, Nil Serra, Xavier Serra Gallifa, Nicolas Soler, Sergio Vicente Molina, Jorge Villanueva.

ALBA-CELLS, Barcelona, Spain

ABSTRACT

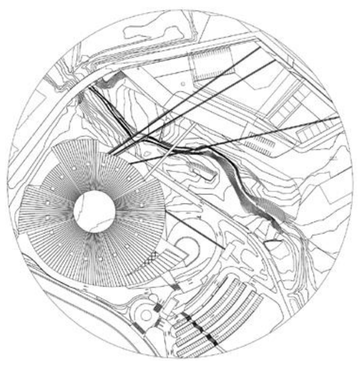
The ALBA Synchrotron has started the work for upgrading the accelerator and beamlines towards a 4th generation source, the future ALBA II, in 2030. A complete redesign of the magnets lattice and an upgrade of the beamlines will be required. But in addition, the success of the ALBA II project will depend on multiple factors. First, after thirteen years in operation, all the subsystems of the current accelerator must be revised. To guarantee their lifetime until 2060, all the possible ageing and obsolescence factors must be considered. Besides, many technical enhancements have improved performance and reliability in recent years. Using the latest technologies will also avoid obsolescence in the medium term, both in the hardware and the software. Considering this, the project ALBA II Computing Preliminary Study (ALBA II CPS) was launched in mid-2021, identifying 11 work packages. In each one, a group of experts were selected to analyze the different challenges and needs in the computing and electronics fields for future accelerator design: from power supplies technologies, IOC architectures, or PLC-based automation systems to synchronization needs, controls software stack, IT Systems infrastructure or machine learning opportunities. Now, we have a clearer picture of what is required. Hence, we can build a realistic project plan to ensure the success of the ALBA II. It is time to get ALBA II off the ground.

The project

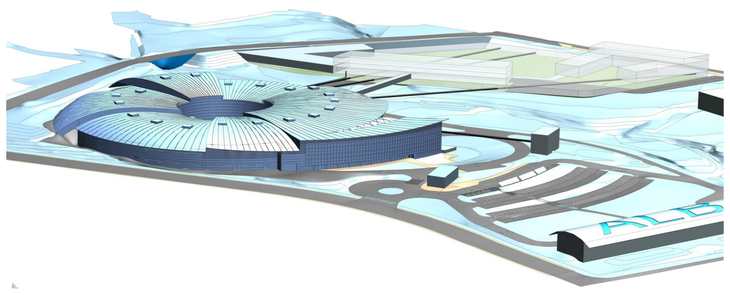
Key figures:

Evolution of the ALBA			
	2023 – ALBA (currently)	2029 - ALBA	**2032 – ALBA II**
Accelerators	3rd generation	3rd generation ALBA II ready to start installation activities	**4th generation**
Beamlines	10 in operation 4 in construction	14 in operation + 3 in construction	**17 in operation (including 2 long beamlines) Could be potentially increased up to 26 beamlines**
Additional experimental capacities	JEMCA (2 TEM with partners), Battery lab	JEMCA & InCAEM (3 TEM + 3 add microscopes) + Catalysis lab	**New plots will host additional labs with institute partners.**
Users, experiments and annual beamtime	2.500 users 300 experiments 46.500 h	3.500 users 400 experiments 65.000 h	**4.250 users 500 experiments 79.000 h**
Publications	300 / year	400 / year	**500 / year**
Industrial use	60 experiments/year	85 experiments/year	**100 experiments/year**

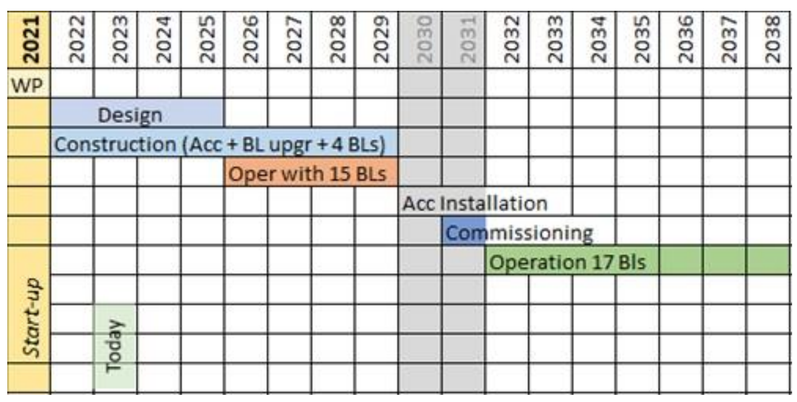
Extension of plots



New technical buildings construction



Master Project Schedule



Computing Division Studies

Power Supplies

- + 1100 power supplies will be required in the new SR.
- Architectural design changes will be mandatory in the power converters to guarantee beam availability
- Works started in 2023 to ensure mission-critical Booster PS lifetime for the following decades.

Motion Control

- IcePAP will be used as the standard motor controller.
- Piezo-based motor for sub-nanometer resolution must be mastered.

Input/Output Controller

- The current solution based on CompactPCI Standard must be replaced.

Protection and Automation

- The new standard for PLC will be built based on OPC UA.
- PSS requires of a complete renewal which will include a Digital Twin

Timing System

- The system used at ALBA will be replaced.

Configuration Management and Stock Management

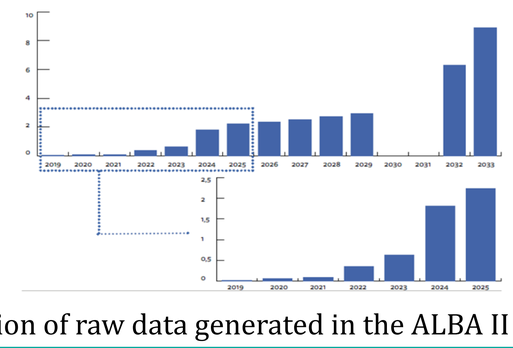
- Current hardware Configuration Management is undergoing a significant upgrade.

Control System Stack

- **TUPDP076** in this poster session provides information about the need for a complete redesign

Scientific Data Management and IT Infrastructure

- The volume of data generated in the ALBA II will boost.
- An ambitious IT Systems investment program is part of the ALBA II project



Estimation of raw data generated in the ALBA II

	2023 – ALBA (current)	2029 - ALBA	2032 – ALBA II
Storage	4.7 PB	18 PB	34 PB
CPU Processing (nodes)	500	13.000	28.000
GPU Processing (CUDA cores)	12.500	190.000	400.000

IT infrastructure prospects at ALBA II

CONCLUSIONS

The ALBA Synchrotron is already on its way towards the ALBA II. The additional plots required have been obtained, and the two first years studies for the updated magnet lattice have already given their first results. In parallel, the different groups are putting in a lot of effort to build the ALBA II master project plan in March 2024. The grant of the increased multi-annual budget is expected for next year, which will enable the start of its execution. The plan will not be limited to the development needs for the new source. Still, it will include the required investments to guarantee operation for the following decades, the roadmap for the different technologies adoption, and the strategic developments required to ensure the scientific success of the ALBA II.

The road to reaching ALBA II is still lengthy. However, we have started at a brisk pace.

Detailed information is available in the ALBA II White paper through the following link:
https://www.cells.es/en/science-at-alba/alba-ii-upgrade/alba-ii