ALBA Synchrotron Heading Towards Its Upgrade C. BisCari, E. aignEr, K. attEnKofEr, J. C asas, s. fErrEr, o. M atilla, J. niColas, r. P asCual , f. P erEz, M. P ont, and a. sanChEz ALBA Synchrotron, Barcelona, Spain 1.It is motivated by the needs of three focus areas; life sci- ence, including structural molecular and integrative biology; energy, especially catalysis for carbon neutral economies and batteries for short term storage and electro-mobility; and information technology enabling the digital transformation, which mainly focuses on emerging technolo- gies and materials but extends to state-of-the-art device structures with increasing microscopy capabilities.By substantially contributing to ALBA II construction, the Span- ish and European research instrumentation industry is provided with opportunities to develop products and train their personnel in ac- celerator and X-ray technologies, competitively entering a global growth market characterized by the struggle of satisfying the in- creased requests caused by many simultaneous synchrotron upgrade projects worldwide.37, No. 1, 2024, Synchrotron radiation newS Technical RepoRT Environmental sustainability is incorporated in the ALBA II design and construction at different levels, starting with the definition of build- ings and services, continuing with specific requirements on call for ten- ders or detailed specifications of the constructive design.The injection scheme is based on a single fast pulsed multipole kicker magnet, the Double Di-pole Kicker (DDK), a 400 mm long in air kicker, composed of 8 con- ductor rods fixed on a ceramic vacuum chamber, titanium coated on the inner surface.ALBA II, with its boost of microscopy and imaging capabilities in combination with the extended energy range, reduced beam size, and improved data pipe- lines, will allow investigation into broader, more complex sample sets with a strong focus on applied science and industrial needs.Round beam operation is be- ing analyzed for a substantial improvement of the lifetime and it is also preferred for many experimental techniques since the photon beam co- herence lengths in the vertical and horizontal directions are equal.XBPMs will also be located in each front- end and the possibility of using them into the FOFB will be studied for those BLs that need it. Corrector magnets will be implemented as stand- alone devices in the straight sections and as extra winding in sextupoles inside the cells, keeping the system very compact.Introduction The ALBA Synchrotron light source [1] provides extended research capabilities and a wide range of state-of-the-art instrumentation to aca- demic and industrial users of the Spanish and European Research Area.ALBA delivers the Spanish research community another gate to the larger European research network and infrastructures, especially through the participation in LEAPS, the League of European Accelerator-based Photon Sources [2] and is one of the players of the recently published European Strategy for Accelerator-based Photon Sources (ESAPS 2022 [3]).ALBA II long BLs will extend to the nearby plots (see Figure 1), where there is opportunity to combine the corresponding experimental hall with new scientific and technological institutes.ALBA industrial users, of which 37% are small and medium enterprises (SME), belong mainly to the pharmaceutical, nanotechnology, advanced materials and chemistry sectors.The high magnetic field density requirements for the magnets im- plies very small vacuum chambers radius and the use of the new NEG coating technology with state-of-the-art functionalities.Thanks to its large circumference, the existing ALBA booster deliv- ers a small-emittance beam suitable for the injection into the upgraded storage ring, and does not need an upgrade.Building on operational excellence, this strategy pivots around multimodal characterization, in-situ and operando capabilities, fast, accessible high throughput capabilities, and the participation of the big-data world.org/licenses/by-nc-nd/4.0/), which permits non-commercial re-use, distribution, and reproduction in any medium, provided the original work is properly cited, and is not altered, transformed, or built upon in any way.The 3 GeV electron energy will be maintained, while the nominal current will be increased from the present 250 to 300 mA. The ALBA II lattice, fitting into a 270 m long circumference, will be very compact.Four straight sections have high-betas, one for the injection, two for RF cavities, and one is available for one ID. Dynamic aperture optimization is being carried out with the applica- tion of genetic algorithms.The ALBA 500 MHz RF system is maintained, with the addition of a 3rd harmonic system to increase the bunch length and lifetime and to decrease the Intra Beam Scattering effect.Beam stability better than 10% of the beam size will be guaranteed by a Fast Orbit Feedback (FOFB) system, which will use the 10 kHz data stream from hundreds of Beam Position Moni- tors (BPM) around the ring.The combination of a large research infrastructure and a science and technology park, situated near the Barcelona universities and research centers, along with the proximity of the Autonomous University of Barcelona [4], will foster research, innovation, and economic growth.In collaboration with the user community, ALBA has developed a holistic approach focusing on the big scientific, economic, and ecologi- cal challenges our society faces.A new one, the Interdisciplinary and MultiModal Section [6] covers JEMCA (Joint Electron Microscopy Center at ALBA), a recently inaugurated ad- vanced microscopy center in partnership with other institutions.ALBA is ready to leap from the 3rd to the 4th generation and give birth to ALBA II by combining the upgrade of the storage ring with that of the existing instrumentation and the addition of new cutting-edge beamlines (BLs).The ALBA-II project has the following objectives for day-one: - Renovation of the accelerator structure and adaptation of the cor- responding infrastructures.The design is based on MultiBend achromat cells configuration [7] (see Figure 3), reducing the horizontal natural emittance to about 200 pmrad, a factor of 20 lower than ALBA's.37, No. 1, 2024 19 Technical RepoRT Three sections cover the three strategic areas: Life Science, Chemical and Materials Sciences, and Magnetic and Electronic Structure.Dedicated and advanced proprietary services have strengthened the industrial community supporting its technological innovation.ALBA will maintain its relevance in the future research infrastruc- ture landscape by upgrading to a 4th generation light source, ALBA II, which is planned to become fully operational in 2031.- Development of further capabilities for automatization, simula- tion, prototyping, nanotechnology and advanced optics.ALBA II is giving way to modern resource and energy consumption schemes re- sulting in more efficiency and less environmental impact.ALBA II accelerator, sources, and beamlines 3.1 Accelerator The upgrade will transform the ALBA storage ring into a high coherence light source.High stability diagnostics adapted to the small beam size, and com- pact accelerator will be distributed along the ring using all the available space between magnets.ALBA evolution from 3rd to 4th generation ALBA is a Synchrotron Light Facility managed by the Consortium for the Construction, Equipment and Exploitation of a Synchrotron Light Laboratory (CELLS) in operation since 2012.It is a member of the Spanish Map of Infraestructuras Cientifico Tecnicas Singulares (ICTS) [5], and it is a non-profit public entity supported by the Spanish and Catalan governments.This is an Open Access article distributed under the terms of the Creative Commons Attribution-NonCommercial-NoDerivatives

License (http://creativecommons.ALBA is developing its new services and infrastructures, ensuring the fast and easy role out of new services to the broad existing user community.The terms on which this article has been published allow the posting of the Accepted Manuscript in a repository by the author(s) or with their consent.Published with license by Taylor & Francis Group, LLC Synchrotron radiation newS, Vol.– Renovation of existing BLs, including instrumentation, data stor– age and analysis system.All current BLs will be overhauled to adapt them for fully exploiting the high brilliance of the new pho– ton source.The BL which will enter in operation in 2026 is already optimized for ALBA II characteris– tics.It will be a cost and time effective process, prof– iting at maximum from all existing infrastructure, in particular the building, which is now hosting the facility.The injector, the accelerator tunnel, and the Insertion Devices (IDs) will be maintained.The overall ring symmetry is preserved: the lattice is composed of 16 cells organized in four quadrants.ALBA is a 3rd generation, 3 GeV synchrotron light source, with 11 BLs in operation.Two additional BLs, now in commissioning, will start operation in 2024 and another one, currently in the procurement phase, will start in 2026 (see Figure 2).The great level of collaboration between visiting scientists and expert staff is a key element of the evolution of the com– munity.An adjacent land plot has been acquired to allow the extension of the infrastructure and to allow the construction of up to three long beam– lines, as shown in Figure 1.Their experimental stations can also be the seed for new research centers in collaboration with other institutions.Their design, construction and installation are carried out while operating ALBA; commissioning is postponed until the .new source is available.20 Vol.2.3