STATUS OF THE ALBA PROJECT

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Abstract

ALBA is a third generation light source under construction near Barcelona, Spain. ALBA consists of a 3 GeV storage ring, a 100 MeV LINAC and a full energy booster. The LINAC has been installed and conditioned. The Booster synchrotron is fully installed, with a first period of commissioning performed in January 2010. The installation of the Storage Ring is well under way, with the commissioning planned for the fall of 2010. The commissioning of the beamlines should take place in winter 2010, with the first expert users expected in January 2011.

STATUS OF THE BUILDING

The ALBA building is almost completely finish and operational. 16 out of the 17 contracts are either complete or in the finishing stages. The only pending contract is the one for the control of the conventional facilities (water, cooling, electricity, etc) in process of commissioning.

The final connexion to the electrical grid, through a nearby co-generation plan will take place in the period July-September 2010, with the first cold water from the plan being delivered in July 2010.

LINAC

The LINAC has been manufactured by Thales, and it was fully commissioned by December 2009, fulfilling all the specifications [1]. The LINAC still requires further optimization, for better understanding of the Twiss parameters at the exit.

BOOSTER

The Booster synchrotron is full installed, and first period of commission took place for two weeks in January 2010. All the subsystems were commissioned beforehand, fulfilling the specifications. The electron beam was ramped up to circa 2.8 GeV.

Another period of commissioning is plane by July 2010 [2, 3, 4, 5].

The average pressure in the vacuum chambers of the booster was in the low 10^{-9} mbar range, the vacuum system proved its reliability during the booster commissioning.

The Booster synchrotron has been commissioned using the final control system for ALBA, Tango. This involved a full commissioning of all subsystems: Vacuum, Radio Frequency, Diagnostics, Power Supplies, Timing, Equipment Protection and Personnel Safety have been put in operation. The Matlab MiddleLayer was widely used during commissioning.

STORAGE RING

Installation

The installation of the storage ring [6] started in April 2009. The strategy that has been weekly followed had been:

- Pre-alignment of 2 girders in the horizontal plane in the Experimental Hall (EH)
- Insertion of the pins that will define the position of the magnets (EH)
- Installation of quadrupoles and sextupoles securing them in the girder (EH)
- Moving the 2 girders for one sector inside the tunnel
- Install the 2 dipole magnets
- Open the all the magnets
- Install the pre-assembled vacuum chamber for the 2 sectors (see figures 3 and 4).
- Check that the position of the BPM's with respect to the girder is correct
- Vacuum test the chamber and connected it to the ion pumps
- Close the magnets

Figure 1: View of the tunnel, with the booster synchrotron in the right and the storage ring in the left.

The installation of the 16 sectors was performed in 16 weeks, i.e. 1 sector per week. After that the straight sections had been installed and in-situ baked-out.

The RF cavities have been installed at the beginning of 2010 and the installation of the injection straight is being finished right now. After this the mechanical installation of the storage ring will be completed.

Meanwhile the infrastructure installation for cabling and cooling system, as well as for the Personal Safety System is proceeding and the expected schedule for the sub-system commissioning is July to October of 2010.

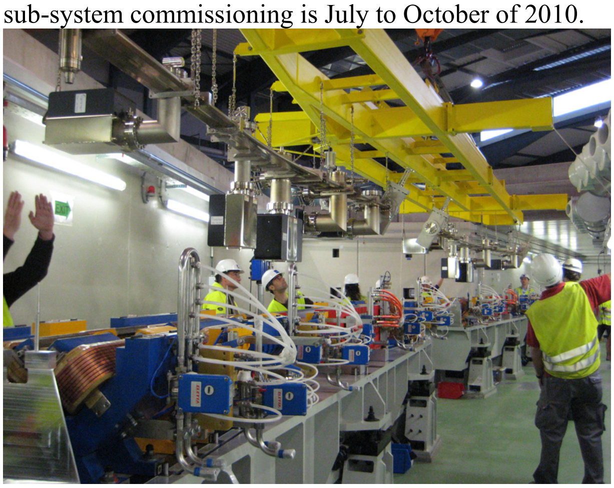

Figure 2: Installation of the vacuum chamber.

Pulsed Magnets and Power Converters

The last component of the storage ring received where the pulsed magnets. All the magnets are now in-house, and being measured. The results fulfil the specifications ([7], [8]).

Vacuum System

The main mechanical installation of the vacuum system for the storage ring took 4 months, this included the assembly in the clean room, bakeout ex-situ in the oven, moving the sector under vacuum to the tunnel, installing it on the girder and operating the ion pumps, as describe previously. The average pressure inside the vacuum chambers is the low 10^{-10} mbar range ([9]).

Figure 4: Installation of the vacuum chamber.

RF System

All components of the SR RF system are already installed: cavities, transmitters, waveguide and LLRF electronics [10]. Figure 3 shows a pair of Dampy cavities installed in the tunnel. Nowadays we are finalising the installation of the cabling and of the cooling piping. The problem of overheating of the dampers, when reaching power over 50 kW has been solved by an improved flange design.

Prior to installation, all the six SR Dampy cavities have been conditioned in our test stand up to 80 kW, ensuring in this way its proper performance. This process will also help for a faster conditioning in the tunnel.

The RF commissioning of the transmitters is being done these days by the manufactur, afterwards the Digital LLRF will be commissioned by ALBA. It is foreseen to have all ready for the conditioning of four cavities in the tunnel by the end of July. The last two cavities will be conditioned at the beginning of October.

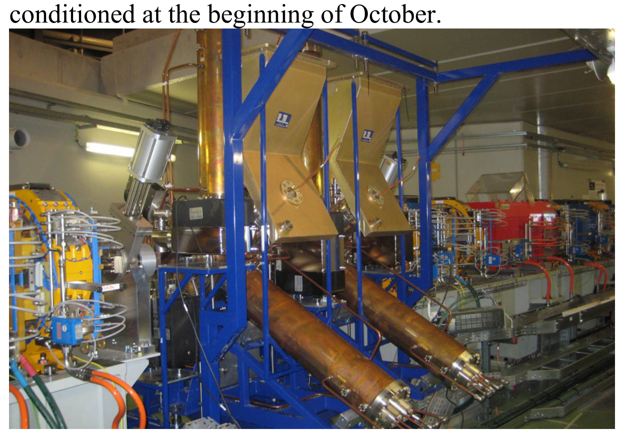

Figure 3: 2 Dampy cavities installed in one of the medium straight sections of the Storage Ring.

Beam Dynamics and Commissioning Preparation

The study of the effect of the phase one insertion and of the high order multipole of the magnets has suggested a change of the working point and of the sextupole scheme ([11], [12]).

The installation of the Matlab MiddleLayer for booster, transfer lines, and the Storage Ring is almost completed.

Diagnostic

All the components of the diagnostic system are already installed in the storage ring and transfer lines. The frontend for the diagnostic beamlines are installed, and their hutches are under construction.

Insertion Devices

The list of first insertion devices includes: 2 planar PPM SmCo in-vacuum undulators with the period of 21.6 mm; 2 Apple-II type PPM NdFeB undulators with the periods of 62.36 and 71.36 mm respectively; 1 superconducting planar wiggler with the period of 30 mm and a maximum field of 2.1 T, and a 1 conventional wiggler with the period of 80.0 mm and a maximum field of 1.74 T. The emitted light of these IDs covers wide spectral range extending from hard X-rays to UV. Pre-design of the IDs was done by ALBA, but manufacturing has been outsourced. Production is now finished and they have been tested with magnetic measurements. The two Apple-II and the conventional wiggler are already delivered to ALBA, and assembled in their carriage. The superconducting wiggler is in process of assembly in ALBA. The two in vacuum wiggler are expected to be deliver in July 2010 ([13]).

Beamlines

The installation of the 7 phase one beamlines is well under way. All hutches are already installed, as well as all the optics elements. The rest of components will be installed during the year 2010. The beamlines would be ready to start commissioning with synchrotron light at the start of 2011.

Figure 5: One of the in vacuum devices to be installed in ALBA.

Control System

The Alba Control System is built on the middle layer provided by Tango and uses extensively Python for both device servers and clients. A common control software package named Sardana [14] has been developed. This integrates the graphical layer and tools (named TAU) and based on Python, facilities for hardware configuration, sequencing, macro libraries, optimization of concurrent access to hardware and more.

The controls infrastructure for the accelerators includes more than 300 racks and a total number of 6000 equipments. More than 150 diskless industrial computers, distributed in the service area and 30 multicore servers in the data centre, manage in the order of 7000 process variables. The data centre will have a storage capacity close to a petabyte, providing high performance and high availability.

The timing system [15] is based on events with hardware provided by MRF. Events are distributed by fiber optics for synchronizing more than 240 elements based on events in the nanosecond range.

A central equipment and cable repository manages all the definition and location of equipments in racks, equipment types, cables, installation status, etc. This repository is also used for automatic code generation.

Most of the hardware required by the Control System is already installed, with the commissioning of the subsystems under way.

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