MIRAS status

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MIRAS is one of phase II beamlines, currently in the construction stage at the ALBA synchrotron light facility. Once completed, it will provide ALBA facility users with a modern infrared microspectroscopy facility optimized for work in mid-IR region.

MIRAS' project at ALBA was launched in 2009. Experimental options in both the far-IR and mid-IR regions were projected with the capacity to address the present and future requirements of the scientific community not only in Spain but also in Europe as a whole. The project was formally approved for funding in 2010, but was frozen due to the difficult economic situation in the country. However, by the end of 2013 the project was reactivated again, thanks to a close collaboration between staff from ALBA, SOLEIL and the CSIC.

This project is being developed together with the mechanical engineering group led by Carles Colldelram and the optics group led by Josep Nicolas in close collaboration with the rest of ALBA's divisions. Very recently, in March 2015, Ibraheem Yousef has joined ALBA as the person responsible for the beamline.

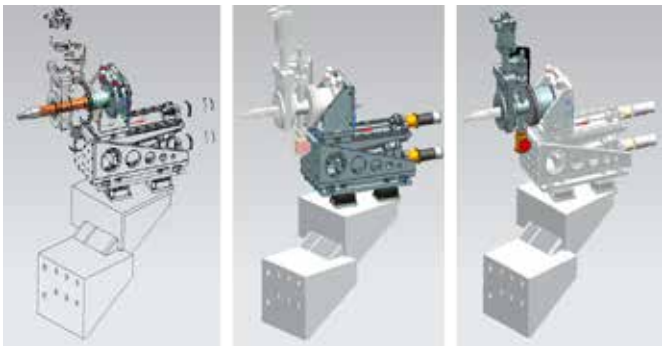
Bending Magnet 04 of the ALBA Storage Ring was selected, after careful analysis, to become the IR radiation source for the MIRAS beamline. A modified dipole chamber enabling collection angles of 43 x 25.17 mrad^2 was installed during the summer shutdown of 2014. The dipole chamber design implements horizontal IR beam extraction geometry using a laterally inserted flat mirror. The mirror is provided with a horizontal transverse slot in order to avoid interaction with the central high energy core of the dipole emissions and thus avoid thermal loading. Only the IR and visible light fraction of the dipole radiation emissions is collected by the mirror and redirected towards the emission port. A high stability XYZ positioning system for M1 mirror, designed by ALBA engineers in collaboration with colleagues from the SOLEIL SMIS beamline, allows for a crucially important accurate positioning of M1 mirror with respect to the dipole emission fan and electron beam (see Fig.3).

During the winter shutdown (in December 2014), a tunnel wall drilling was performed by the Infrastructure section of the Engineering division to accommodate the emission port of MIRAS (see sequence of pictures in Fig. 4).
At the time of publication of this article, all hardware parts of M1 Extraction are being manufactured. It is planned to have them delivered and tested during the first half of the 2015 summer with subsequent installation in the dipole chamber during summer shutdown period.

After the extraction, IR beam is transported through an optical train of 1:1 symmetrical imaging scheme to the first endstation inside the MIRAS experimental hutch in the hall. It is scheduled to have the MIRAS experimental hutch erected and functional by the end of the first half of 2015. The design of the experimental hutch foresees two more downstream endstations as a near future upgrade of the MIRAS beamline. One of them is projected as a customizable platform for experiments with user-supplied equipment under the BYOD (Bring Your Own Device) policy.

The optical design of MIRAS includes the option for splitting IR beam in two parts, separating the dipole emission and edge radiation fractions of the IR beam. This enables to use them either separately at different endstations or to deliver both fractions to the same endstation. At the end of the transport chain, a confocal scanning system will deliver a beam of approximately1000x the brightness of a conventional infrared source into a spot of 5-10 µm diameter in a commercial FTIR microscope endstation.

Ray-tracing and optical simulations have been carried out using SRW, RAY, SpotX and ART codes in order to simulate IR beam propagation and verify the optical layout. Specifications for the mechanics of the main optical elements comprising the beam transport system as well as mechanical designs have been completed and are about to be manufactured. They are planned to be delivered by the end of 2015. After appropriate commissioning, MIRAS is expected to carry out measurements in Autumn 2016.



Extraction mirror | XYZ Positioning stage | Vacuum interface with dipole chamber

Figure 3: 3D model of the IR extraction mirror assembly for the MIRAS beamline. © ALBA Engineering division

Figure 4: Sequence of images of the tunnel wall drilling done in December 2014. © ALBA Engineering division