



LLAMA News

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Web page: <http://www.llamaobservatory.org>

The Large Latin American Millimeter Array (LLAMA) is a collaboration between the Ministerio de Ciencia, Tecnología e Innovación Productiva (MINCyT), the Consejo Nacional de Investigaciones Científicas y Técnicas (CONICET), the Instituto Argentino de Radioastronomía (IAR), and the Instituto de Astronomía y Física del Espacio (IAFE) from Argentina, and the Fundação de Amparo à Pesquisa do Estado de São Paulo (FAPESP), the Universidade de São Paulo, and the Universidade Mackenzie from Brasil.



LLAMA staff

The system engineering and project management has been strengthened by including Rieks Jager as Project Manager and Eng. J. P. García from October 2016. Eng. García will share the tasks of Project and System Engineer with Eng. J. J. Larrarte.

LLAMA site at Alto Chorrillos

Measurements of ground resistivity at the LLAMA site

Between November 28th and December 7th technicians P. Alarcón and P. Ottonello and Eng. E. Rasztocky from IAR, along with the collaboration of C. Peralta (Ph.D. In Geology) from CAPACITAR Foundation and R. Bega from INENCO carried out measurements of ground resistivity (ρ [Ωm]) in the site of LLAMA (Antenna site "0" at 4830m above sea level in Alto Chorrillos) and at the location where LLAMA's headquarters at San Antonio de los Cobres (SAC) will be constructed. The resistivity of the ground was measured in order to design both the appropriate grounding that will be part of the foundations in each site and the lightning protection scheme. The measurements were taken following the Werner and Schlumberger method which gives values to characterize soil resistivity with depth.



Taking measurements was not an easy task due to the soil characteristics.

Access to the summit

The construction of the access road to the summit at Alto Chorrillos (about 6 km in length) started early December 2016. By the time of this writing, more than 3.5 km of the road have



already been opened. Therefore, depending upon local weather conditions, the access road may be finished by end February 2017.

The bidding process also includes the opening of the access road to the location where the tower having the transmitter of the holography system will be installed, the levelling off at the summit of a 100m x 100m area, and the antenna foundation.



Access road to the summit. Preparing for the road construction.

12m Antenna

Foundations

A study to determine the geo-technical properties of the soil at the place where the antenna will be located is being performed during the second week of January. This is a necessary step to completely define the technical specifications for the antenna foundation.

A group of experts, headed by Eng. J. J. Larrarte and including Drs. José Viramonte, Carlos Peralta, and Silvina Echazú, Engs. Carlos Bellagio, Claudio Ríos, Nicolás Guerra, and Emiliano Rasztocky, is in charge. Final specifications will be reviewed by V. Heinz (ESO), as external advisor.

Antenna foundation related work should start during February.

Transportation to Alto Chorrillos

All documents associated with the bidding process for the transportation of the antenna from the arrival port in Argentina (Zárate, Buenos Aires province) to Alto Chorrillos (Salta province) were sent to the legal department of "Fundación INNOVAT" by mid January for a legal revision. In the mean time, the process for identifying the custom broker and the company that will do the actual transport are being carried out. Eng. J. J. Larrarte is in charge of this task.



Infrastructure at San Antonio de los Cobres (SAC)

The Ministerio de Economía of the Salta province has already allocated the necessary funds to proceed with the construction of the first stage of the LLAMA's headquarters at SAC. This step encompasses 470 m² out of a total of 1130 m². Construction may start by mid February.

Optical telescope

Tania Domenici from the Museu de Astronomia e Ciências Afins (MAST), in Rio de Janeiro, Brasil, will be in charge of developing the mechanical system for the optical telescope. This is an important project needed for pointing and for calibrating antenna tracking. Should it is not ready for first light, alternative solutions are being considered.

Holography

Different alternatives for the construction of the LLAMA's holographic system are being considered based on costs and availability in time. Negotiations to borrow an holographic system for LLAMA's first light are being carried out.

Hardware activities: Backend/frontend

Analog rack & spectrometer

The prototype of the LLAMA back-end downconverting system is currently under implementation at NOVA, Groningen, Holland. This system is composed by 2 basebands of the whole back-end, providing 4 GHz of instantaneous bandwidth. The LLAMA back-end will provide, once constructed, 16 GHz of instantaneous bandwidth. It is expected to receive the first 2 out of 8 XFFTS spectrometer boards at NOVA in late January. These 2 boards will provide enough resources to process the entire bandwidth provided by the back-end downconverting prototype. Eng G. Gancio (IAR), now at NOVA, is in charge of these tasks along with people at NOVA. Based on the prototype test results, the final back-end will be constructed at IAR.

M. Luqueze and S. Verri (from escola Politecnica, USP, Brasil) went to NOVA on mid January to participate in this project. They will be there until April.

The spectrometer is being purchased to RDG.

Calibration loads

The first down payment to Universidad de Concepción, Chile, to proceed with the design



and construction of the calibration loads was made. The group lead by Eng. R. Reeves (CePIA) is in charge of this development.

The proposal to design the mechanical support of the calibration loads presented by C. Fermino (e-Fe, Tecnologias Industriais, Brasil) has been accepted by LLAMA's Executive Committee. The head of this group (Eng. C. Firmino) will work in close collaboration with Eng. R. Reeves. Eng. Manuel redondo (IAR) will collaborate with the construction and verification of the calibration loads.

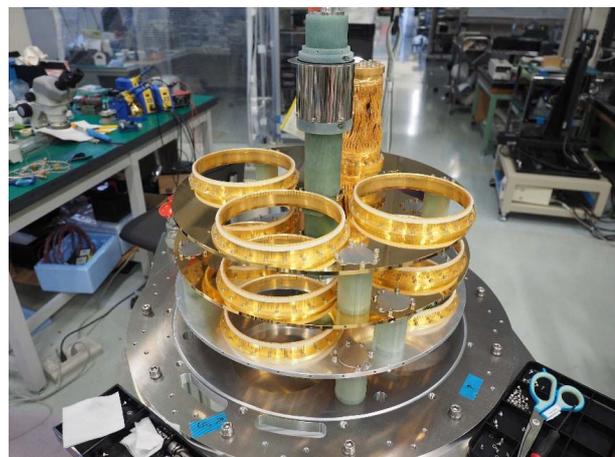
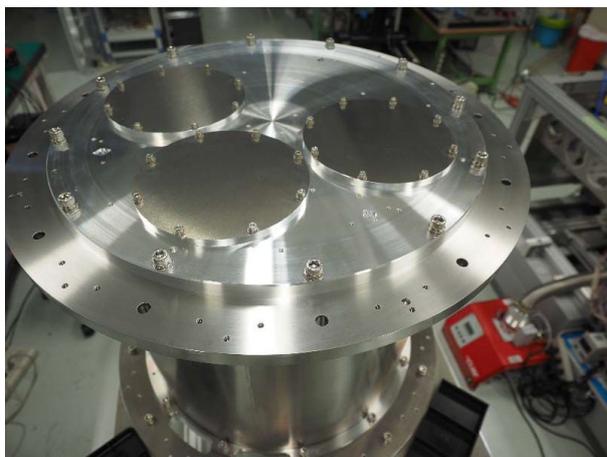
NACOS

The design of the Nasmyth Cassegrain Optical System (NACOS), which includes both Nasmyth cabins and the cassegrain area, is completed. For first light Nasmyth Cabin B will be available with receivers for Bands 5 and 9.

Plane mirrors will be used instead dichroics for first light. Their construction is being analyzed presently. Eng. C. Firmino is in charge of the mechanical support of the mirrors.

Cryostat & receivers

The LLAMA cryostat, constructed by NAOJ in Japan, will accommodate 3 ALMA compatible receivers, so-called Cold Cartridges Assemblies (CCA). The cryostat is currently on its early stage of assembling and testing at NOVA. The tests results so far, show the expected performance, achieving the vacuum and temperature required by the CCA to work in optimal conditions. This temperature is as low as 3 K!. The cryostat will be integrated with the receivers and all the supporting electronics at NOVA and further testing will be performed there, in particular, it is foreseen and end-to-end test where the full cryostat (Front-end) will be integrated with the back-end prototype and the spectrometer for the very first time.



Views of the cryostat



A memorandum of understanding (MOU) was signed between Instituto de Astronomia, Geofísica e Ciências Atmosféricas Universidade de São Paulo and ESO regarding the use of the Band 5 receiver by the LLAMA Project. The receiver was sent from ALMA to NOVA for a design upgrade, integration, and further testing.

Band 9 receiver, a DSB instrument provided by NOVA, is on its final stage of upgrade and is expected to be ready for integration along with the Band 5 receiver. Both receivers will be part of the first light Front End.



Receivers for Band 5 and 9 for LLAMA

Computing Development

During the last months the effort of the computing teams, headed by Dr. G. Gimenez de Castro, was centered in the development of the hardware and software to link the antenna to the control software system. The antenna has a built-in interface computer called Antenna Control Unit (ACU). Commanding and monitoring go through this computer. The LLAMA control software has its own antenna computer interface called Antenna Bus Master (ABM). ABM and ACU are communicated through a CAN bus and synchronized by a 48 ms pulse called Timing Event (TE). In July 2016 IAG received from Vertex Antennentechnik GmbH a spare ACU. Since the ABM is not ready, a simple CAN bus was implemented by means of a Beaglebone board and commands were sent from a laptop. With this setup both the normal functioning of the ACU and many of the antenna movements were checked. Meanwhile the ABM is being built at IAR, and should be ready during March 2017.

We have started a collaboration with Dr. François Viallefond (Observatoire de Paris) who is the main developer of the Science data Model (SDM). A Data Model is a central piece of the software, since it has impacts in all the different subsystems, from the hardware to the scientific layers. LLAMA decided to adopt the SDM, which is already in use at ALMA and VLA.



Observatoire de Paris, SDM copyright owner, agreed to provide the last version (SDMv2) to the LLAMA project, and Dr. Viallefond will assist the LLAMA computing team in making the necessary adjustments and extensions.

LLAMA at LARIM

LLAMA was presented during the XV Latin American Regional IAU Meeting last October in Cartagena de Indias, Colombia. J. Lepine gave an Invited talk; E. M. Arnal an oral presentation; and P. P. Beaklini, a poster presentation.