

Recommendations from the MAC Meeting of 21 Nov. 1998

The MAC met with representatives from NRAO and the MDC on Nov. 21, 1998 at the O'Hare Hilton in Chicago to discuss the status of the MMA/LSA project. One of the goals of this meeting was to identify unresolved technical, scientific, and managerial issues and to make recommendations.

The project has advanced at a rapid pace since this time last year. Paramount was getting the D&D phase funded through the NSF and steadfastly pursuing the European collaboration, which appears to be close to consummation. We congratulate the project manager, director, NRAO staff, and MDC groups who have all contributed to the successful start of this project. The following are our responses to the various issues brought to our attention during the meeting and, for the most part, for which recommendations were requested by the NRAO staff.

1) Antenna Size

This is an issue that should be resolved as quickly as possible. The US working group on antenna size has concluded that the science goals will not be seriously affected by the choice of antenna size, if the antenna diameter is in the range of 10 to 12 meters so long as that antenna meets the specifications set for the MMA antenna. The final decision on the antenna diameter will obviously require agreement by the European partners. We recommend that a committee composed of US and European scientists be appointed to resolve this issue as quickly as possible.

2) Antenna Design

The two design groups (NRAO staff in Tucson and Woody and Lamb at OVRO) have made tremendous progress. Both designs are mature enough to reasonably assess how well they will meet specs. It appears that both will meet specs for a 10m antenna. The Woody-Lamb design appears to be a bit more innovative and to meet the specs with more cushion for error than the Tucson design. A 12m antenna is likely to require a departure from conventional antenna design. Our recommendation is to resolve the size issue and then proceed with a request for bids on a design and prototype antenna.

3) Receiver Bands

We completely agree with the Frequencies Working Group (Memo 213) that all frequencies are important from a scientific point of view so the goal should be to achieve complete frequency coverage (excluding opaque bands of the atmosphere) from the 3mm window to the 350 micron window. The lowest frequency band should include the SiO line at 43 GHz and extend to as low a frequency as possible with a single receiver.

It is unreasonable to expect all 9-10 receivers to be completed for 60 or more telescopes by the time the MMA/LSA comes on-line. Therefore the plan to install only three bands initially is reasonable. We recommend that two of the 3 bands should definitely be 90 GHz and 650 GHz. The third could be either

230 GHz or 345 GHz; compelling arguments for either can be made. The MAC favored 230 GHz over 350 GHz, but only marginally.

The remainder of the receivers should be installed as rapidly as possible. The MAC foresees a major operation installing more than 400 additional receivers, the logistics of which will have to be carefully planned. There should be a priority ordering of the subsequent bands to be installed as part of the plan of deployment and a time line should be worked out. The preferred sequence of receiver installation should be established on the basis of community input, either via the MAC and its European counterpart or at the Science meeting next year.

4) Correlator: FIR filter

The digital finite impulse response filter (FIR) sounds like a clever way to filter out specified unwanted portions of a spectrum. However, the loss of 13% efficiency is not a good trade-off. We recommend keeping this option open until the correlator design has to be fixed. Perhaps the advance of technology will make it possible to avoid losses of more than a few percent.

5) Phase Calibration

It is important to recognize that both fast switching and water line monitoring will probably be necessary to accurately calibrate the MMA/LSA at the longest baselines and highest frequencies. Whether the 22 or 183 GHz water line should be employed will require more testing. Contracting this work out to the MDC as well as actively engaging our European partners and the Japanese in joint design and testing is not only reasonable but wise. A person at NRAO, perhaps the project scientist, should be the point person for working with the various groups on this.

6) Testing of the Prototype Telescopes

The question of whether the prototype antennae should be tested at the Chajnantor site or at the VLA site was raised. Although testing at the Chajnantor site would have the advantage that some early science could be obtained after the test phase, there are also good arguments for doing the initial testing at the VLA site where more technical expertise, test hardware, and personnel are available. We recommend testing the prototypes at the VLA site. When the prototype antennae are moved to the Chajnantor site should be determined by the test requirements of the antennae, array electronics, and software. This could possibly go into the construction phase, at which point adding the two prototypes is likely to make little difference.

7) Observational Simulations

The project needs someone to fill the role previously played by Mark Holdaway. Such a person could

play a key role in refining several issues that were not discussed at the meeting, but which the MAC believes need further study. Among these are:

Total Power Observations

We strongly recommend that this mode of observation be studied in more detail in the coming months. In particular, the requirements for receiver stability, $1/f$ noise, necessity for a chopping secondary, etc. should be better understood than at present.

Array Configurations

We are aware that work is proceeding to define the most useful configurations for the array. This is especially important for the most compact configurations and probably the largest one. We encourage this work to continue until the pros and cons of the various options are well understood.

OTF Mapping

We need to know more about how often this mode of observation is likely to be used. Will it drive the data rate, require special software for analysis of data, and impact antenna design and/or receiver design?

Focal Plane Arrays

The same questions could be asked for the use of focal plane arrays as for OTF mapping. How could space for focal plane arrays be achieved assuming there will be pressure to install them in the future?

LO System

The LO system is not yet well defined. In particular, the laser LO system seems to offer some major advantages but the photo mixers do not work. Is the laser system possibly the best way to produce and distribute the LO signal even if the photo mixers do not work? A classical multiplier system will work and involves less risk, but involves building a very large number of multipliers. This issue needs more study.

These are issues that should be the subjects of future MMA memos and possibly future MAC telecons.

8) Advisory Committees for an International Project

Assuming the MMA/LSA collaboration becomes a reality, the MAC recommends that an international scientific advisory committee to the project be established as soon as practical. If NRAO and the European partners wish to continue separate advisory committees, we strongly recommend that at least one representative from each committee be invited to attend the meetings of the other to keep communications open and to avoid misunderstandings.

There is a strong possibility that five advisory committees could evolve for the MMA/LSA; the MAC and its European counterpart, the NSF advisory committee and its European counterpart, and an international advisory committee. We believe so many advisory committees would be counterproductive and advise that the separate US (MAC) and European committees should be reformulated

into a single international advisory committee when it is practical to do so. This committee should be large enough to represent the range of interests of the astronomical community but small enough that effective discussion and consensus can be reached.

9) Management

The MAC recommends that during both the D&D phase and the Operations phase, a single individual should be the recognized person in charge. This individual should have access to funds from both partners and authority to make decisions in the best interests of the project or facility. Of course, this person should be answerable to the funding partners by a mechanism to be defined.

10) Scientific Meeting

The MAC fully supports a scientific meeting in the Fall of 1999 to showcase the science that the MMA/LSA will be able to perform in the 21st century. The MAC will be happy to work as the US Scientific Organizing Committee for this meeting.