OPT status per July 2008 and early Ka-band observing

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This memo is intended to serve as input for management (RD+BB) to help in deciding (near the date of July 14 2008) whether the EVLA Observation Preparation Tool (OPT) has the potential to support early Ka-band observing late 2008/early 2009 using only EVLA antennas and the existing (old) VLA correlator.

SUMMARY: In our view some essential but lacking items in the OPT need to be addressed to make it ready for early Ka-band scheduling by the end of 2008. Specific essential items include the generation and extensive testing of EVLA observing scripts as well as providing readable documentation. Other crucial points that need attention are database registration, the generation of summary listings, calibrator searching, Doppler tracking, and the logistic implementation of dynamic scheduling.

We have reviewed the OPT as it was available in early July 2008; tools included in the OPT are the Source Catalog Tool (SCT, source lists), Resource Catalog Tool (RCT, hardware configurations) and OPT (observing scan lists, program and scheduling blocks). In working with these tools we have come up with the following remarks and points we consider most important for making a decision about releasing the OPT for Ka-band observing.

The topics discussed below are

- documentation
- robustness of the web interface
- user interface and friendliness
- general functionality
- functionality specific to Ka-band (i.e., high frequency)
- missing policies and other decisions

Of course there are many points that could be addressed here as well, including wish-lists and useful gadgets. We have left these issues out of this document so that we are not distracted from the current objective: early Ka-band observing.

Documentation

Documentation so far has been sparsely addressed other than noting it has to be available, both in paper form as well as embedded in the software tool (e.g. fly-over help). Clearly this is an essential part of the OPT, as Ka-band proposers will not be as experienced as the in-house testers. Some remaining features and unexpected behavior may remain in the OPT during the transition (EVLA antennas with VLA correlator) period and fixing them may distract from the greater goal (WIDAR implementation); therefore these features need to be properly documented. We expect the documentation to evolve with the use of the OPT, in particular after outside testers have been invited to use the OPT. Anticipating an iterative process taking several months, and assigning an insider as OPT help contact for the outside testers (Lorant?), it should be possible to have a usable, fairly complete version of documentation available by the end of 2008. Part of Lorant's time is reserved for making this happen. This item should be reviewed continuously, e.g, on a monthly basis.

Proper documentation is a requirement.

Robustness of the web interface

The OPT (with its sub tools SCT and RCT) is based on a web user interface. Perhaps due to changes requested by the testers, we occasionally have had problems with the robustness of the tool. That is, occasionally the server would crash, which of course should not occur when the OPT is released to the community. Though serious efforts have been made by the programmers, we have not yet been able to determine whether such crashes have been completely resolved. Although it seems unlikely at this stage, we cannot properly assess whether the web interface has fundamental flaws. Further testing, especially by those outside the Pete V. Domenici Science Operations Center (DSOC), is needed to continue to expose problems in this area. If outside users encounter frequent crashes which cannot be resolved, this is a point of major concern.

A stable and robust web interface from users both outside and inside the DSOC is required.

User interface and friendliness

The use of the OPT and its look and feel have had several revisions, and we believe it has converged to a point where preferences of testers have been taken into account. Some items are hard to understand without proper documentation, e.g., the difference between program and scheduling blocks, or not being able to edit some fields. There are a few features that may need improvement (e.g., pasting of scans) but if these features are documented properly they will not be show-stoppers.

It is not clear to us how the interaction with the Proposal Submission Tool (PST) database is currently organized - NRAO should avoid double registrations and work (entering data) at all cost - effort should be made to extract data from the PST data base to fill into the OPT, and to have a

single point of access to all NRAO web services. (In the not-too-distant future the PST and OPT, as well as other observing and scheduling tools, should access the same database.)

A single login to the user database for any NRAO web interface is required.

General functionality

The basic functionality of the OPT and its associated tools is currently present except for the generation of observing scripts, i.e., the output of the OPT that serves as input to the executor (see below). That is, sources and hardware configurations can be entered in the system and can be retrieved upon subsequent (re-)logins, as can scan sequences in program and scheduling blocks. Validation tests are applied and immediately return feedback on warnings and errors to the user about potential scheduling conflicts - until further and more specific testing occurs, we currently assume these warnings and error messages are correct and complete. It would be useful if the errors could be exported to a file for further investigation if needed. The interface appears to allow, with some features needing proper documentation, most operations we can think of that a user would want to do at any observing band. Timeout and recovery procedures are implemented and appear to work. When a schedule is created without errors, it should be possible to inspect it in a user friendly, readable way. That is, simply writing out the observing script to a local text file is not sufficient; the OPT should be able to make human readable summaries of scan, setup, time, frequency, etc., so that the observer can assess the schedule on a one-line-per-scan basis, and in hardcopy form when necessary.

The generation of readable summary listings is a requirement.

For now, the development of a calibrator search and selection tool has not been pursued extensively and the implementation of such a tool, perhaps not as stand-alone graphical tool but a more simplistic query return integrated in the SCT, is being discussed. By including calibrator source lists from the SMA, CARMA, IRAM, ATCA, etc., the availability of (high-frequency) calibrators has been expanded compared to the VLA-only calibrator list. However, many lists contain common sources and searching them may be a bit tedious with the current search capability. Small improvements in the search and presentation of good calibrators (e.g. sorting on distance to the target) can greatly facilitate calibrator searches. We thus would like to see a more sophisticated (calibrator) search tool (or more sophistication for the current tool) that at least has the following additional feature: The search tool should allow the selection of a position or a source (without re-entering coordinates) for which nearby calibrator sources are requested within a given radius limit, and which returns a list of sources found in the VLA calibrator list (or any other list) sorted on increasing distance to the selected position/source. It should be possible to copy a source from the returned list for pasting to another list (scan list, private source catalog).

An improved (or improvement on the current) calibrator search tool is a requirement.

The telescope motion model has not yet been extensively tested by us; however, we think the results will not differ significantly from the current VLA telescope model; wraps can also be specified. However, the telescope model needs careful testing, and the results must be compared to the real telescope motion. Reading source lists created for import to the PST by the OPT is possible in

principle, but needs some documentation and debugging to work flawlessly.

The main purpose of the OPT - generating an observing script that can be executed by the EVLA operators - has not yet been demonstrated. This probably consists of just adding lines of code, but because it is essential to get this absolutely right it may not be that straightforward. At this point we cannot test the observing scripts to be generated for correctness. When the code is implemented it is necessary that these scripts be extensively scrutinized and, e.g., compared to observing scripts generated by "obs2script". We anticipate that this implementation will require iterations with on-the-sky testing of the scripts which may take a significant amount of time (perhaps intensive testing for several weeks). For example, the scripts for pointing scans must correctly feed the determined offsets to the on-line antenna control system. The ability to write correct observing scripts and the testing of these scripts should have the highest priority of the programmers (and testers) in order to use the OPT for early Ka-band observing.

Writing correct observing scripts (and completely testing them) is required.

As we expect many Ka-band (and perhaps extended C-band and extended L-band) proposals to be narrow band spectral line proposals which are to be scheduled dynamically, observing using Doppler tracking (versus fixed frequencies) is in our view critical to the success of early Ka-band observations. We understand that this implementation may be complicated, especially when generalizing to the use of WIDAR, but at least it should be capable to perform scan-based Doppler tracking on a single IF-pair (if not both IF-pairs).

Implementation of Doppler tracking is a requirement.

Special observing modes (solar system, pulsars) have not been implemented and it is our understanding that implementing such modes are low priority. As long as potential proposers are made aware of this policy, we have no problem with not supporting those special observing capabilities (moving sources, solar attenuation, pulsar gating) for early Ka-band proposals.

Functionality specific to Ka-band (i.e., high frequency)

Below we comment on some specific capabilities that we think are necessary for early Ka-band observing:

Dynamic scheduling on the VLA is currently implemented by means of scheduling durations, versus absolute UT and/or LST — when a dynamic scheduling block is selected, the observing script is generated from an old-style observe file. Constraint information is passed to the scheduling database via special comments in the observe file. It is unclear how dynamic scheduling will work with observing scripts generated by the OPT. Somehow the dynamic constraint information must be passed from the OPT to the database for the dynamic scheduler, so that it is able to select observing scripts based on current weather and other constraints. The creator of the schedule (observer) must be able to enter this information in the OPT, e.g., using the scheduling block page (under scheduling constraints).

The capability to specify dynamic constraints (to be passed on to the dynamic scheduler) is required.

Fast-switching is implemented by means of scheduling scan loops. Pointing (including secondary pointing) is implemented by means of scheduling pointing scans. Testing is necessary to determine whether the actual observing script does the right thing. It is essential to have fast-switching and reference pointing working (including secondary pointing scans) but can only properly be tested on the sky. At this time we don't think this will be problematic when scan scripts work.

Successful testing of pointing and fast-switching scans is a requirement.

We don't think tipping scans or special calibration scans are implemented or are necessary for early Ka-band observing; currently most high-frequency observers do not use tipping scans, and they are not encouraged to do so. Observing polarization or bandpass calibrators (etc.) does not seem to be different from other scans above. Other calibration types that we can think of (pointing model, delays, antenna positions, absolute flux density scales) are for testing and operational purposes and not for general observations such as early Ka-band observing as anticipated for the proposal call.

Missing policies and other decisions

NRAO/VLA management and the Proposal Selection Committee must be very clear in the call for Ka-band proposals and the selection of successful proposals on which kinds of observing are supported, and inform successful proposers that they will need to use the OPT, which, at first, may require a new, perhaps steep, learning curve in order to create their scheduling blocks.

Conclusion

In our view, the list of requirements for the OPT to be fulfilled for smooth successful scheduling of early Ka-band observations is:

- Proper documentation
- A stable and robust web interface from users both outside and inside the DSOC
- A single login to the NRAO user database for web interface
- Generation of readable summary listings
- An improved (or improvement on the current) calibrator search tool
- Writing correct observing scripts and their complete testing
- Implementation of Doppler tracking
- Capability to specify dynamic constraints
- Successful testing of pointing and fast-switching scans

– LOS – GVM – MJC – END –