Comments on:
Software Science Requirements and Use Cases

The following file includes all comments received as of February 27, 2001
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Tue Feb 27 17:12:05 MET 2001

Comment 001 by CWilson

... No General Comments ...

Comment 002 by DGRoh

... No General Comments ...

Comment 003 by GHarris

After reading the document again, I decided to leave the UC alone and comment mainly on the assumptions and definitions. There is some repetition in the UC and different styles from different writers, but until there is a first pass by everyone to gather all content, the UC are OK. Later we can factor and consolidate the various features.

I have tried to direct my comments to information in the document, aiming for clarity and completeness and looking also for policy issues. There are no comments on typos, grammar or differences in Am-British English.

Reply: The factorization will no doubt be needed at a latter stage.

Comment 004 by GRaffi

General:

Congratulations to the SSR Committee and Use Case Group. We have now a very solid requirements basis for the software development work.

Reply: thanks ...

Comment 005 by JSchwarz

... No General Comments ...

Comment 006 by LTesti

The document describes the details of the science software requirements and use cases in great details and I think that it is an excellent work. This preparatory work is an essential step toward the successful completion of such a large software project. The task of handling with a single software project the proposal phase, array hardware operation, raw data flow, real time pipeline processing, science data archive operations and offline data processing is fascinating and should certainly be pursued for the ALMA project. Given the complexity of such project and the basic requirement that the software (each of its components) should never be a bottle neck for array commissioning, interim phase and routine operations it is essential to devise technical and scientific priorities for the software project. This has been attempted with success, I believe, in this document.

I have a few general comments and a number of minor details about the text. As I noted at the previous review, I am not a software expert, so my comments are made from the potential user point of view.

General comments:

1. Offline processing.

While the real-time pipeline is described at length, the plans for the "offline processing" are much less clear. This is important since, especially at the beginning of array operations, it is likely that the pipeline real-time processing, if present, may not perform the best or "customized" processing required by every possible project. In fact, it is foreseen the possibility that the user may recover the raw data from the archive and reprocess them. The "pipeline" (or some of its subsystems) should thus have the same portability and power of standard data reduction packages (or, better, should be more portable and more powerful...).

There are two possible alternatives:

a- pipeline runs only in the archive centers (such as OVRO-MMA software).

pros: latest version always available to the user, no portability problems, direct easy access to the archive.

cons: data centers must be able to handle in reasonable time requests from many users across the network, users have to transfer the products of each of his tests on the data.

b- pipeline is available to every user (such as AIPS, GILDAS or MIRIAD).

pros: limited network dependence; user "only" downloads raw data once then fiddles with the calibration of them on his/her laptop on the plane while traveling to a conference where is expected to give a talk based on that data; easier to customize data calibration for special needs.

cons: user has to install the software and is responsible for its maintenance, the software has to be compatible with a number of different platforms and easy to install.

It is not clear in the document if a decision between these two options has been taken, and which is preferred. The requirements and design are very different, I believe. In any case, I think that the offline processing (or the compatibility of the ALMA data calibration with existing packages, even tough I would not recommend this option) should have priority over the real-time pipeline. This does not mean that it should be designed without aiming at the pipeline, but that it should be designed in such a way that it will FIRST be implemented as offline processing and THEN as real-time pipeline. The goal will be to achieve the latter before array interim science operations, but the first part HAS to be ready for that (in my opinion). Ideally one would like to combine the best of the two approaches with an easy to access archive through the net and the possibility of running the calibration software on a copy of the raw data transfered onto the users computer.

Of all the data archive systems that I have ever used I find the OVRO one the most user friendly and "ready for me" anytime, I can decide that I want to look at the data on Sunday afternoon, I just connect prepare my tables remotely and start to calibrate, the drawback is that I really need it to be working on Sunday if I want to do the actual calibration over the network from Italy...

Interaction with other archives has been a nightmare: you prepare the request, then you must wait until somebody in the staff has the time to look for the CD and/or tape, retrieve the data and decide if you can have the data through ftp or other means (god forbid!).

Ideally, of course, you would like to have the best of the two worlds, this is probably already in the plans, but I find that it is not clearly specified in the text.

2. Feedback to the proposer.

This is an important point, I think. After the execution of a scheduling block the system should send a feedback to the proposer. Not only when it reaches a breakpoint, always! The proposer will not have direct contact with the observations and this feedback will be critical. For example there may be occasions in which the proposer looks at a subset of the data and may decide to change the observing strategy (without the need of a previously set breakpoint). I had recent bad experiences with serving observing: observing blocks being observed in service observing without telling me and without sending me the data for weeks. This is something that has a very bad impact on the proposers. You do not want to have people checking daily the archive to hunt for possibly executed subsets of their projects. At zeroth order something like the VLA observing log should be sent via email after observing, on the long term the goal should be to send a more detailed report, something similar to what is done at OVRO, but automatically generated by the data reduction pipeline. All these points should be in the scheduler and pipeline requirements.

3. Priorities.

In such a large project priorities are essential. I would order the requirements by priority (for easier reference) and would assign a different requirement number to tasks at different priorities. Also the priorities for the use cases are all "critical" and "major" (it is unclear to me which is higher priority) what does this mean exactly and which relationship exist between these two classes and the four priority classes defined in the requirements section (2)?

Reply:

– Point 1.
We are now starting to work on a document specifying the requirements for the science data pipeline (in more detail) and for the off-line data analysis. It is clear that the pipeline software (as such) will only be supported at the ALMA

archive sites, while the off-line analysis packages should be supported by their non-ALMA developers at the PI home institutes. This is in no way in contradiction with the pipeline being built upon such off-line data analysis packages.

– Point 2.
There is clearly a lack of requirements in this area. Our proposition is to require for feedback to the proposer (in addition formal acceptance and information needed before phase II preparation) is the following:

1. An e-mail is sent to the PI when the first of his/her SBs gets into the top $\sim$ 10 ranked ones, as an announcement of approaching execution (but not a guarantee, the weather being not easily predicted)
2. An e-mail is sent to the PI when the first of his/her SBs has been executed once.
3. At this point, a Web page is created (password-protected) that will be updated at regular intervals (e.g. each SB, or $\sim$ 10min whichever the greatest). This may include the quick look image, quality check information, from the quick look pipeline, and general execution status of the programme.
4. An email is sent at the end of each session (either due to a change in scheduling or a breakpoint status).
5. A final email is sent at the end of the project (when all the data is archived and available).

– Point 3.
We have included priorities in the requirements. We have concentrated in the most important Use Cases as input for the software first analysis, hence their high priority. Lower priority use cases will no doubt be encountered later.

Comment 007 by MHoldaway

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... No General Comments ...
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Comment 008 by MOhishi

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1.  General Comments

  First of all I would like to appreciate to the ALMA SSR committee for the preparation of the ALMA
  Science Requirements and Use Cases.  This is a quite dense document to prepare, indeed.

1) Science Requirements (SRs)

  I agree with the adoption of the GUIs for general user interfaces.  GUIs are easy to handle for
  novice users rather than the command line input.  It is necessary to have traditional commands to
  control ALMA hardware and software for experienced and expert users, staff astronomers and
  operators.  However, the design of the GUIs should be self-explained, because it is expected that
  not all ALMA users are expert of the radio interferometric observations.

  I found some discrepancies between the SRs and use cases (UCs).  For example,

  - a UC for the position-switching mode exists, but there was no description in the SR (maybe added
  in 2.2 R4?),

  - there is a requirement for the VLBI observations in the SRs, but nothing (I believe) is
  described in the UCs,

  - polarization observations are not required in the SRs.  However, three UCs describe on
  polarization calibrations.  Do I misunderstand ??

  - Which type of Archives do we need from scientific purpose ?  I found several types of archives,
  such as raw data archive, science archive, calibration archive, etc.

2) Use Cases (UCs)

  I understand that the UCs are some kind of object oriented concepts to describe recipes for ALMA,
  and found it very useful.  However, because the overall relationship or interconnections of the
  UCs are not shown, it was hard, for the first stage, for me to understand all the UCs.  It is
  desired to provide a figure to show the relationship of the UCs.
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Reply: We will:

1. The list of oberving modes, from memo 293, will be included in 2.1-R5.
2. Explain better the motivation of the Use Cases (mainly at this stage needed to show examples of use aimed at software analysis and design, rather that show a full description of all modes).

A first analysis document will soon be available and will contain such graphical information.

Comment 009 by NEvans

Review of software requirements and use cases

Overall, this document is a very good step forward, which also identifies areas where further information is needed. In terms of organization, I think it would help if Appendix A on Observing Objects came earlier, since it explained a lot of things and would have made the more detailed use cases clearer. A few things should be defined more clearly, such as "interim science" and "widely open for science" on pg. 7. Also, the ACA is not incorporated into most of the use cases. It looks like the ACA is still the first priority of the ASAC, so we hope we get it. This has implications for data rate and how certain modes work. Also, in most places one talks about conditions on tau, but not on rms phase. The latter should be included. A related idea is that of "stringency". Roughly this could mean how much constraint the observational requirements put on the system (e.g., only the lowest tau and best seeing and specified UT would be VERY stringent). Leaving aside fixed UT, one could estimate fraction of time tau and seeing conditions would be met as a quantitative measure of stringency.

Reply: We will refer more explicitly to the concept of stringency in the actual wording of scheduling requirements. ACA will be the subject of an appendix with its own requirements, as the concept of this extension to ALMA seems now about to stabilize, after both the ASAC meeting and the configuration PDR. The meaning of priority levels will be better explained.

Comment 010 by RTilanus

I would like to congratulate you all on the substantial progress and the large number of details that have been worked out since last year. As a matter of fact, the document is quite overwhelming given the level of details and the short time allowed to review it. Consequently, I admit I have not read all UCs with equal attention and skipped over many of the details with the assumption that the UCs will keep on developing. Gamma Ray Burst 20010222 did not help either. Instead, I have tried to concentrate on the broader issues. Given my own expertise these mostly deal with the user interaction rather than the technical details of the operation.

Concentration on these broader issues:

1) I admit this is one of my pet issues, but I was surprised to note that there are no less than 5 UCs dealing with the definition of the programme (8 including the Scheduling Blocks) and NOT A SINGLE UC DEALING WITH THE COMMUNICATION WITH THE USER ONCE THE OBSERVATIONS HAVE STARTED!

Stating that the observer will be notified, that the pipeline images will be available for inspections, and that the system will be able to handle break-points is roughly equivalent to providing a single line dealing with the programme: 'the observer will submit an observing program which will result in observations being scheduled'.

With dynamic scheduling and break-points that deal with complex programme issues it is IMPERATIVE that 'Communications and Feedback' is an integral part of the science requirements and not something that is bolted on at a late stage.

Making a simplifying assumption that the average observing programme will get 2 hours per night, operations will have to deal with 84 sets of observations and, thus, communications with up to 84 observers per week. That is not something you can simply leave as an instruction to your staff scientists.

The type of things I have mind and which should be generated and/or digested automatically, are:

1. Sending the observer a note when his/her observation is started (optional, but nice in case intermediate images etc. will be available to the remote observer during the observation).

2. Notifying the observer when observations for his/her programme have been carried out and where to find the pipeline images. The sending of the notification should be logged in the DB.

3. (optional) The observer must acknowledge this notification e.g by clicking some button on a web-site (or replying to the email in which case 'vacation' replies need to be trapped). There should also be a provision to alert the observatory about problems with the data: any information entered will automatically be forwarded to operations/support scientist. All this should be logged in a DB.

4. In case of break-points being reached: 2 and 3 are MANDATORY. In case of no response from

the observer, messages should be repeated until at some predefined time operations is notified of the lack of response.

5. 1 - 4 should also approximately happen in case the observer initiates the communication (e.g. programme update).

6. The observer and operations should automatically be alerted to programmes which have been on hold for a while (e.g. break-points).

etc.

All this is not terribly difficult but it must be automatic and reliable for the operations to be able to depend upon. Hence it warrants a UC.

2) An issue which is not clear from the UCs is the way 'Observation Programmes' and 'Scheduling Blocks' will be used. Specifically: will the observatory ever receive the Observation Programme? Compare UC 3.1 pg. 24 'Basic Course item 1' with the 3.2 UCs which only refer to the Phase II Scheduling Blocks.

Permit me to expand a bit, since the answer has a direct bearing on what UCs need to be considered . The issue is not a technical one: it hinges on the question whether or not you think that an Observation Programme can be fully specified as a set of Observation Blocks. My own experience is that this almost never the case in the sense that the Observation Blocks are fully independent. This is acknowledged in UC 3.2.6 pg. 38 item 8.

You can have a lot of fun trying to come up with complex dependencies, most of which I have encountered here at the JCMT at some point and some are even quite common:

- Observe object A, B, or C, but once started on e.g. A don't start on B or C until stop criteria for A (rms, time, etc.) have been reached. Note that the observations on A may span a number of SBs (since they typically are 15-30 min.) both because of integration time and frequency coverage.

- A programme with a possible target list of 100 sources with a single setup: do you really want the observer to create 100 SBs?

- Breakpoints can affect all SBs of a program or only ones associated with the same source or frequency setup.

- SB outline in Appendix A: dependencies because of UV coverage.

- chaining (DBs need to be done together in any order as a block or spaced by no more than 'x' time) and sequencing (SBs need to be done in a particular order but not necessarily together).

etc. etc.

It is hard to see how these requirements can be encoded within the SBs.

As a counter example the Gemini OT essentially creates a 'programme' which is submitted to the observatory. The programme is loaded into a object-oriented DB and Scheduling Blocks are being extracted 'in-real-time' at the telescope just prior to submitting the observation. I believe that while the OT is used by observers to define their observation programme, at the telescope it is used to actually submit the observations. Comparing this setup with the ALMA outline, they seem to be extreme opposites since from the documentation I have read it appears that only Scheduling Blocks will be submitted by the observer.

I am skeptical about whether Gemini's setup will work well: it seems to me that while the object oriented DB can accommodate a lot of complexity that does not guarantee that it will be dealt with correctly. Instead, I much prefer the SB approach where the dependencies MUST be explicit after ingesting the Sbs into the SB database.

However, I do believe that the observer should submit an Observing Programme which upon reception will be stored and from which SB's will be automatically generated to be validated and to populate the SB database. The observer should not have to deal with SBs, only with the programme as a whole (to validate his/her programme SBs may need to be extracted but only the validation routine needs

to see those). When making changes, the observer should make the change in and resubmit the programme and not change a particular SB after checking it out from the DB. One advantage (some may feel this to be a disadvantage) of a programme -- rather than Sbs -- being submitted to the observatory is that you can deal with some of the dependencies directly in the SB database instead of having to design a way to write them into and extract them from the SB.

Well, I have flogged this one to death I guess.

3) UC 3.1 "Observe with ALMA" is very general and is not being worked out further. This is somewhat surprising given the amount of details in e.g. the UCs dealing with the Proposal I phase.

On the other hand, Appendix A nicely lists the actual context of the UCs by outlining an observation. It is clear from the UCs that they were developed with something like described in Appendix A in mind. Hence, I suggest that the information in Appendix A is converted into a UC as a first draft of a UC which will be a comprehensive description of a project, configurations, and observation modes.

This UC logically connects the 'Requirements' and UC 3.1 with the rest of the UCs. Currently a number of the detailed UCs are difficult to place in context because the background information (I assume) resides in other documents.

4) In its present form the document contains very detailed and worked out UCs (i.e. Phase I, and e.g Setup/Observe/Reduce Gaincal) mixed with cases which have not been worked out to the same extent e.g. UC 3.8.4: Flux Calibration.

5) I am going out on a technical limb somewhat, but from the UCs it seems that they have been prepared by interferometer and single-dish types separately. At present it appears that it has not been considered how to operate one or the other mode while having access to the alternate one. I.e. with the interferometer around, it appears that one would prefer to point in interferometer mode rather than total-power mode even if the observations will be TP. Similar, with an interferometer it is possible to measure and fine-tune the side-band ratio of DSB receivers, removing one of the main uncertainties of single-dish tunings. These may be other examples.

Perhaps at some point it may be useful to have a brain-storm session on how to use such a dual-mode instrument and what special UCs may result from it.

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These 5 points summarize my comments on the general issues and the philosophy underlying the UCs.

Since I am running out of time, here are my other comments most of which are essentially questions which probably highlight my own lack of knowledge of the details involved:

Reply:

- Point 1.
  See above (reply to comment 6) for the feedback to users. This will be also the subject of an Use Case. The email exchange will be logged in a data base.
- Point 2.
  We will explain more extensively what we mean by 'dependency rules'. This is basically what you meant: being able to test the status and status-related parameters of all the programme's SBs. We mention explicitly the need to cope with large surveys and thus large source lists.
- Point 4.
  Many of the details in the Use Cases will need a full Calibration Plan to be specified. A Calibration PDR is to be planned ...
- Point 5.
  Obviously many of the calibrations should be done preferably in interferometry mode, even for total power observations. Nevertheless e.g. pointing will be occasionally needed in total power modes as well, for many reasons. Please remember that these Use Cases are not the Calibration Plan, only examples of practical array use, described here to achieve a better characterization of the software.
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... No General Comments ...
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Comment 012 by JSchwarz

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p. 6

  "uncalibrated uv data will be archived..." this isn't entirely consistent with 7.0-R4 (p. 22)
  which states that it may be desirable to keep "both the corrected and the uncorrected data"
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Reply: The question of path length correction in 7-0-R4 is at the sub-integration level, while we are dealing here with instrumental calibration on a longer term.

Comment 013 by JSchwarz

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p. 6, par. 2, line 3 "calibrations curves" should be "calibration curves"
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Reply: to be corrected.

Comment 014 by NEvans

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p. 6

  Clarify origin of data rate estimates (and include ACA).
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Reply: We'll refer by URL to the software note (Scott et al.) where this is explicited. ACA will come in an appendix (see comment 009).

Comment 015 by GHarris

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p. 7

  1.0-R6 = the term near real time should be expanded or reduced to real time

  1.0-R9 = rates are stated here and again in 2.3-R4. Is the General section a summary or does it
  have priority over the Data Collection section?
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Reply: We'll expand; it was felt useful to summarize these important numbers in the General section.

Comment 016 by LTesti

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p 7

- Priorities should be stated in time-schedule terms (all 0-1-2 are essential features to me), I
  propose to call: 0 "Must be there for commissioning" 1 "Must be there for interim science" (which
  I am not sure what it is actually, I presume a "science demonstration phase", prior to proposals?)
  2 "Must be there for routine science operations", 3 "Desiderable feature".
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Reply: see comment number 009 above for priorities

Comment 017 by LTesti

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p 7

1.0-R7 should be 2 (You will have to refine the pipeline in 1)
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Reply: This is more intended as a summary; further down the priorities for pipeline requirements range from 1 to 3

Comment 018 by LTesti

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p 7

1.0-R9 should be 1, you want to be able to sustain the full data rate during science demonstration
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Reply: Science demonstration will be made with a limited number of antennas; the full data rate will only be needed when all baselines are present.

Comment 019 by NEvans

p. 7

1.0-R7 should be priority 2

Reply: This is more intended as a summary; further down the priorities for pipeline requirements range from 1 to 3

Comment 020 by TOhnishi

Page7 s2.1

1.0-R1 1.0-R4 "should not assume detailed knowledge of millimeter astronomy" "expressed in terms of science parameters"; What parameters are the knowledge or expression in terms of science parameters? The parameters should be listed when the software is developed. For example, the selection of pointing sources and calibration sources is one of the most difficult procedure for the people who is not familiar with millimeter astronomy. So, the automatic suggestion of the sources is useful.

Reply: By science parameters we mean map size and resolution rather than actual fields and configuration, velocity widths rather than bandwidth for spectroscopy, noise level rather than integration time...

Comment 021 by GRaffi

p.8
1.0-R11 managed at the system level..

Reply: We do not mean here software components but rather hardware components e.g. receivers for which the actual malfunction would be in some cases only detected in the pipeline.

Comment 022 by GRaffi

p.8

6.1-R13 is the same but has a clearer formulation: a status report will be logged at the system level. One requirement for this should be enough.

Reply: may be you're right, we might keep only 6.1-R13 ? may be this one is best placed here to attract attention.

Comment 023 by JSchwarz

p. 8,

1.0-R11, line 2 "system maintenance and" should be "system maintenance staff and"

Reply: Agreed.

Comment 024 by MHoldaway

p. 8
1.0-R11 I hadn't anticipated this, but it is an excellent idea.

Reply: Thanks.

Comment 025 by CWilson

p. 9

2.1-R9 -- as mentioned at the ASAC meeting by someone, I'm not sure we would always want array calibration sessions to have the highest priority. For example, in extremely good weather and with some time-critical project, it might be better to do science with all the available telescopes than to use some of them to do, say, baseline calibration for antennas that were recently moved. Perhaps a manual override option would be sufficient?

Reply: There is an override option in the scheduling anyway; starting these calibration sessions is manually done by the staff so this question is one of observatory policy.

Comment 026 by CWilson

p. 9

2.1-R11 -- it seems to me that we might need to be able to dynamically schedule the operation of the ACA or total power observations separately from the main subarray. For example, the ACA might be continuing integrations on programs requiring short spacings while the main array might be doing point source detection. How hard would it be to have two or three dynamically scheduled subarrays?

Reply: This is only getting clear now (after the ASAC meeting and configuration PDR). ACA and main ALMA scheduling as two independent instruments is probably quite easy; we'll add an appendix later for ACA related requirements.

Comment 027 by GRaffi

p.9
2.1-R2,R3,R4 Manual, Interactive, Dynamically scheduled mode

I understand the different capabilities meant here. However when it comes to the design it might well be that the best is that OT fulfills all these needs. This would mean that in Manual Mode OT allows the user to browse and use his own scripts, adding a GUI on top which will allow flexibility and generality to those scripts as they will have to accept parameters (so they will become similar to standard scripts). In interactive mode the user will control himself the flow of SBs that will have been prepared passing parameters to standard scripts corresponding to the various observing modes. In dynamic scheduling mode the user will simply keep his fingers away and the OT will execute SBs as proposed by the Scheduler up to a Breakpoint.

Reply: This is what is planned: user interactive input will be through the OT and SBs will be executed one by one.

Comment 028 by GRaffi

p.9

2.1-R8 allocation of antennas to subarrays. Does this imply 16 subarrays max and therefore 16 sessions max ?

Reply: probably yes ! (may be not all at different frequencies though ...)

Comment 029 by GRaffi

p.9

2.1-R11 one dynamically scheduled research programme using (most) antennas.. + interactively controlled subarrays. Does this imply that the main programme would use one (and only) one array (which means there would be no need for calibrations on subarrays or single antennas being part of the main program and going on in parallel)?

Reply: We'll explain this better. We'll take out the minimum number of antennas, replacing it by an observatory supplied parameter.
However the need for 'parallel threads' is sessions seems to be coming along with ACA ...

Comment 030 by JSchwarz

p. 9, 2.1-R7

"sub-arrays, operated simultaneously and independently, each being in any of the above modes [technical, manual, interactive, dynamically scheduled]" contradicts 2.1-R11: "...there shall be only one dynamically scheduled research programme at a time..."

Reply: Again we'll make this more clear; but one dynamically scheduled does not forbid as many interactive or manual as needed ...

Comment 031 by JSchwarz

p. 9, 2.1-R9,

Isn't it possible that Targets of Opportunity or high-priority projects requiring exceptionally good observing conditions might pre-empt all other non-safety-related observatory activities?

Reply: As stated above this is a policy issue. We may want to state here possible exceptions to this rule.

Comment 032 by LTesti

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p 9

2.1-R3 I am against "guests" operator/staff is always in control, in the few cases in which the
  proposer may be needed at the telescope he should have staff/operator assistance to operate the
  system.
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Reply: We'll reformulate this to say that observer's input is done under responsibility and with assistance of the operator.

Comment 033 by LTesti

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p 9

2.1-R9 This is not always true (it depends on what you mean by "maintenance" and "resources"):
  suppose that you have taken AN1 out of the array for repainting and you are still observing with
  the other. You send AN1 to stow to do the maintenance, but you do not this command to have
  priority over (e.g.) sending the move to calibrator command to the other antennas.
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Reply: That was priority was meant at the scheduling level, not at the command level. Simultaneous sessions will control antennas totally independently.

Comment 034 by LTesti

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p. 9
2.1-R10 I think that this should be 2.
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Reply: We maintain priority 1. VLBI phased-array mode needs to be commissioned like all others.

Comment 035 by LTesti

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p. 9

2.1-R11 I think that there are only two cases in which observing with independent subarray makes
  sense:

    1- a subset is used for VLBI

    2- One is using a frequency for which not all antennas are equipped with the appropriate
       receiver (this should never happen in phase 2 of the priorities).
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Reply: Point 1: that's only one of many cases; e.g. partial reconfiguration, flux monitoring, tests after maintenance of antennas, observation at several frequencies for time-critical phenomena, use of ACA array ...
Point 2: it should not but we should be prepared if it actually does happen!

Comment 036 by MHoldaway

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p. 9

  2.1-R5 Observing modes: how about a non-dynamic, non-interactive mode?  like submitting a batch
  file, as at the VLA
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Reply: That's either what we meant as interactive mode (using SB's) or then it should be a special case of dynamic scheduling (for observations that need a very specific hour and date.

Comment 037 by MHoldaway

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p. 9

  2.1-R11 Will observers actually give a fair assessment of the minimum number of antennas?  Many
  programs might be successful with 32 antennas, but who will be willing to admit that?  The
  alternative is not nice: assessing requirements of N_ant through sensitivity and (u,v) coverage
  (ie, source complexity) requirements or specifications.
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Reply: The idea was: If you don't do it fairly you run the risk of not being scheduled. Actually it seems that this should not even be a user choice, only the Observatory's policy.

Comment 038 by DGRoh

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p.10 2.2-R8

  I think there should be included "some way to test or check the hardware status in real-time". It
  will be helpful for dynamic scheduling.
```

Reply: The scripts should test the status information, not actually run hardware tests. Monitoring should take care keeping the status up to date.

Comment 039 by GRaffi

```
p.10
  2.2-R2 actually control the hardware for data taking...  Surely it
  will have to be able also to kick off Pipeline reduction as well, at
  least passing parameters to pipeline scripts. This obviously opens
  up the issue if this should be the same scripting language.
```

Reply: That's in requirement 2.2-R7.

[... comment 040 does not exist ...]

Comment 041 by LTesti

```
p. 10

2.2-R1 The observation descriptors as designed are very redundant.  See comment on appendix B below.
```

Reply: see comment NNN

Comment 042 by LTesti

```
p 10

2.2-R3 I did not understand what we are talking about here, but, since subsets have different
  priorities I think that it should be split in two requirements one at priority 0 and the other at
  priority 2.
```

Reply: We decided not to split up comments with multi-priorities. The reason is that for the first phase of analysis and design all priority levels have to be taken into account; it's rather at the later implementation phase that priorities are taken into account.

Comment 043 by LTesti

```
p. 10

2.2-R6 I am not sure it is realistic to hope to implement all of this at priority 2. I would split
  in separate requirements for 1,2 and 3.
```

Reply: On the opposite it's in the first phases that this is needed, until a sufficient level of confidence in the phase correction technique and in an automatic decision mode is reached

Comment 044 by MHoldaway

```
p. 10

  2.2-R1 I don't understand: "minimum amount of data taking..."  ???
```

Reply: We'll try to explain it better. It's the minimum amount of observing activity that can be obtained by a single command in the command language.

Comment 045 by TOhnishi

p. 10

2.2-R8 Timer or timeout command in order to avoid freeze due to the problem of a procedure or the infinite loop. This may be already included in error recovery facilities. The grammar check tool of CCL like lint would be useful.

Reply: This is a good point; we agree that a time out facility is needed and will specify it in 2.2-R8

Comment 046 by JSchwarz

p. 11
2.3-R1

I can't understand what is meant by "The minimum amount of blanked data shall be...smaller than (TBD)...fraction of the integration time." Maybe this could be reworded, perhaps with an example.

Reply: It means that one cannot blank data for a time lower than one correlator dump; but we do not need that high time resolution if the integration time is long enough. e.g. for 10 second integration we allow the minimum blanked time to be 500 ms (or rather 496ms=31*16 ms!). I'll try to explain better ...

Comment 047 by JSchwarz

p. 11, 2.3-R2,

The requirement that flagging information be boolean, particularly in the case of shadowing, where "the amount of shadowing shall be separately kept with data" is an implementation issue, and should be removed.

Reply: It's **not** an implementation issue because pipeline software and off-line analysis software must be able to test this information and obtain a yes-or-no answer. We do not want this to be e.g. an ascii comment in English ... For shadowing we want the amount of shadowing because the PI wants to be able change the limit if he needs to.
We'll say "the amount of shadowing shall be kept along with data, in addition to the flagging information."

Comment 048 by LTesti

p. 11

2.3-R1 I have not understood the "minimum amount of blanked data" part. What does it mean that the "minimum" blanked data should be "smaller" than 5\% fraction of int time if t_int>16ms? If I have t_int=32ms=2x16ms the minimum amount of blanked data must be 50\% (? I miss something).

Reply: Yes it is. See reply to comment 46. We'll make a longer description; the current one is right but obviously not explicit enough!

Comment 049 by MHoldaway

p. 11

2.3-R2 Temperature sensors on the dish and backup could infer when surface errors are likely to be bad, and could infer when the beam quality at high freq is poor, could flag for this reason; temperature gradients could be build up in the time it takes to do one SB, so flagging may be required; certainly would change the currently dynamically scheduled program for large T gradients.

Reply: If these sensors are available in hardware and we can predict the surface rms and loss in efficiency from temperature sensors, then it is good to use this for flagging.

Comment 050 by NEvans

p. 11

2.3-R3 says 64 antennas (ACA needs to be included)

Reply: We'll update to ACA by adding an appendix when ACA is actually in the project.

Comment 051 by CWilson

```
p 12

2.3-R6 -- do you mean that for integration times shorter than the shortest atmospheric time scales,
  only "uncorrected" data shall be recorded?
```

Reply: Since the actual correction is archived too, it's an implementation issue whether we keep the corrected or uncorrected data in this case.

Comment 052 by DGRoh

```
p.12 2.3-R6

  The atmospheric condition may vary significantly within single observing block.  All of
  raw(uncorrected) data and radiometric-correction data must be saved, and then, the corrected data
  may be saved optionally.  On the other hand, if it turned out that the radiometric(or other) phase
  correction would be acceptable, the corrected data could be replaced to the raw data.  I suggest
  that ALMA adopts "a dynamically determined integration time" rather than "usual fixed integration
  time". When the atmospheric phase effects becomes to be measured in real-time, we can dynamically
  determine a best integration time of cross-correlation-correlation data, in the view points of
  minimizing the decorrelation and maximizing the efficiency of data pipeline.
```

Reply: The atmospheric times are so short (¡1s) that this policy would boost the data rates by at least a factor of 10 (and much more on short baselines). Keeping both corrected and uncorrected data will only double it, and we are confident that we'll be able to choose automatically whether to apply the correction or not.

Comment 053 by DGRoh

```
p. 12 2.3-R9
  Very good idea. It could be greatly helpful to the data pipeline.
```

Reply: OK

Comment 054 by DGRoh

```
p. 12 2.3-R10

  For continuum data, the averaging over all channels should be avoided.  According to specific
  backend (correlator), some channels at both edge-side may give bad performance, and some channels
  within bandwidth may show unexpected great values. And there may be included the strong spectral
  lines within given bandwidth for some astronomical sources.  Therefore two or more channel ranges
  should be considered while averaging data for continuum. And, if possible, we should correct the
  bandpass characteristics before averaging.
```

Reply: This is just meant to be kept in addition of the channel spectra, at full time resolution; edge effects will be taken into account. Averaging over user-specified spectral regions (for celestial maser lines, or to avoid atmospheric lines, will be allowed.

Comment 055 by GHarris

```
p. 12
  2.3-R5 = The precision desired should be stated in mathematical
  terms. The format should be left to the implementation.
```

Reply: We may add the formula: it's only the classical root(B.tau). We will give the format only as an example.

Comment 056 by GRaffi

```
p. 12

  2.3-R6 user shall be able to select whether to archive corrected data, uncorrected or both While
  the SSR here seems to be worried to let the user make his choices, these should be confined to
  what he wants to have himself, to the package of data he likes to receive back. I do not think
  that the archive policy should be made by individual users.  It is responsibility of ALMA to
  archive data in an homogeneous way that guarantees a minimum of quality etc for later use by the
  author or by the others (when allowed).
```

Reply: As this user choice would affect the uniformity of the archive we will restrict the choice here to the Observatory Policy.

Comment 057 by JSchwarz

```
p. 12, 2.3-R6,

   Which visibility data is to be kept is to be chosen "on an antenna or perhaps baseline basis" but
   in the same paragraph "This selection shall apply to all baselines". Isn't this a contradiction?
```

Reply: There are options here at two levels: the user (or observatory) choice of policy (corrected, uncorrected, both or automatic), which is global, and inside the automatic policy, the automatic selection, which is by baseline.

Comment 058 by LTesti

```
p. 12

2.3-R6 should be split in 3 separate requirements at different priorities.
```

Reply: we disagree (see above).

Comment 059 by LTesti

```
p. 12
3.0-R8 as above, split in two reqs.
```

Reply: we disagree (see above).

Comment 060 by MHoldaway

```
p12

  2.3-R6 If WVR is used to correct some baselines, but not all, we end up in a regime where the
  phase errors no longer close around a closure triangle, precluding self-calibration.  I don't
  understand why only the WVR corrected data would be stored for short integration times.  It seems
  that there is no need to apply the WVR data in real time (ie, prior to averaging) in this case as
  there is no averaging; so, there is very little penalty for just saving all the WVR data, which
  could be applied on the fly.
```

Reply: on closure relations: for antenna based corrections they are OK; baseline based corrections do not satisfy them, but the atmospheric effect does not either and in a more violent way (decorrelation destroys the amplitude closure relations). The second point is only an implementation decision (see above).

Comment 061 by MHoldaway

```
p 12
  2.3-R11 "The relative channel weights will also be" (too many be's)
```

Reply: That's the question, and the reply too.

Comment 062 by RTilanus

```
p. 12

2.3-R5: Can this be done? Doesn't the correlator need to be operating in 32-bit mode always and on
  all baselines in order to be able to 'dynamically' scale down to 16-bit for storage and does this
  not conflict with the fastest requested data rate?
```

Reply: This is only a question of data format, independently of correlator mode.

Comment 063 by RTilanus

p. 12

2.3-R10: 'integration time' is a bit ambiguous here. I thought that in general the automatically data will be co-added automatically over a number of integrations (i.e. 1-minute records of 10 10-sec integrations). If that is the case there is no reason to keep the 10-sec spectral averages since the smallest unit of correction will be 1 minute. Instead it may be more efficient to store the mean, mode, and sigma over the 1 min. record. This applies to all information on timescales faster than the shortest stored unit of data. This strategy may dramatically lower the demand on the real-time DB. Alternatively, the full data could be kept for a while for diagnostic purposes and at a later stage be compressed into the averages e.g. when moved to the permanent scientific archive.

Reply: We did not make it clear enough obviously. We keep the spectral data with an integration time determined by the changes in u and v, in order not to lower the sensitivity at the edges of the field that is intended to be mapped, and the average of all channels with an integration time dictated by the atmospheric phase effects.

Comment 064 by CWilson

p 13

3.0-R5 -- it seems to me that you may need to allow source identification to be given for more than 10 sources. For example, it may be hard to specify a precise selection criteria that uniquely defines a set of objects, or even if the sample is large, the referee could be interested in precisely which sources will be observed. Requiring source coordinates or names would also be required to check if the sources have been observed before.

Reply: The full source identification will be allowed at Phase I, even for more than 10 sources

Comment 065 by GRaffi

p.13

3.0-R6 Phase 1 tool .. to perform certain calculations. How can it do it, without having the setup that will be only defined in Phase II. A few examples more would help.

Reply: We do a (rough) sensitivity calculation at Phase I based on science parameters (velocity width and resolution); with the full setup a better simulation is possible.

Comment 066 by JSchwarz

p. 13, 3.0-R7,

"...the expert...will be able to override all modes and parameters manually." Note that in this case, the tool will probably be of little help (e.g., in making Scheduling Blocks) from this point on, since it will have lost control of the process. In particular, it won't be able to translate from the changed modes and parameters to "basic input parameters". If the expert is operating in Interactive Mode and expecting a GUI, will he/she be required to pass Scheduling Blocks to the system or script commands, one or more at a time? Expert mode, if not thought out and defined carefully, may hinder ALMA's ability to guarantee data quality and completeness (especially for the Archive).

Reply: We feel the expert mode is needed to avoid having to introduce too much complexity in the OT. The fraction of proposals in expert mode will be a policy issue. The expert scripts will be checked syntaxically and possibly by sending them to the simulator.

Comment 067 by JSchwarz

p. 13,
3.0-R6, "i.e." should be "e.g."

Reply: Agreed

Comment 068 by LTesti

p. 13

```
3.0-R10 There are a (large) number of exceptions to this rule, so it should not be blindly
  implemented, the proposer shall receive a "warning" but the proposal should not be automatically
  rejected.  (e.g. variability studies, deeper integrations, ....)
```

Reply: This will just be a warning, transmitted to the PC as a comment.

Comment 069 by MOhishi

```
p. 13

3.0-R1 : I agree with the electronic submission by default.  Considering that the ALMA is open for
  all astronomers of the world and that in some countries the network environment is poor, don't we
  need to prepare other ways to submit, for example, by traditional mails ?
```

Reply: We'll keep the electronic policy, the load implied by treating paper-only proposals is too large, especially at Phase II.

Comment 070 by MOhishi

```
p 13

3.0-R10 : The basic checking for conflicts is important.  Why not raise the priority to 1 ?
```

Reply: Because it is obviously not needed on the first time; but it will be needed on the second or third call ...

Comment 071 by NEvans

```
p. 13

3.-R4 There should be a choice of several formats and a latex template for generating the proposal
  body, incorporating figures, etc.
```

Reply: The format of the Scientific justification is an implementation decision

Comment 072 by NEvans

```
p. 13
3.0-R5 should include integration time OR rms (as ASAC discussed)
```

Reply: We agree on this point. We'll add the integration time option.

Comment 073 by NEvans

```
p. 13-14

  Somewhere we need to deal with how calibration is actually done; some should be done in a general
  way by the array ops, and some by obs.  The QSOs will vary rapidly at these frequencies and will
  need to be monitored.
```

Reply: There is a strong need for a calibration plan, a calibration PDR, CDR, so that we can finalize the observing and calibration modes.

Comment 074 by CWilson

```
p 14

3.0-R13 -- I don't know if this comment goes here, but the issue of breakpoints made me think of
  it. Should a partially completed program with a breakpoint receive a higher priority for
  completion of the rest of the project? It seems to me there could be several cases here. For
  example, a program which needed to measure 3 specific lines for the science might need a high
  priority to complete its third line. On the other hand, a program that had a breakpoint after the
  first few sources to confirm the program feasibility might not need a higher priority to
  completion after the breakpoint.
```

Reply: The general idea is that a programme's priority increases with the fraction of it that has been already done, unless the PC has said otherwise (as in your second example).

Comment 075 by JSchwarz

```
p. 14,

  3.0-R12 I'd like to see the discussion of how a test source can be used for *real-time* checking
  of data quality expanded. How much checking of data quality should be done by a human being,
  instead, and how much is a requirement on the software?
```

Reply: check the phase rms, check if the flux decreases with baseline length, check the dynamic range on uncleaned map (should be consistent with theoretical beam) ... It basically enables to assess the validity of the phase and amplitudes calibrations.

Comment 076 by JSchwarz

```
p. 14,
3.0-R15, "between" should be "among"
```

Reply: I though between was more appropriate here ?

Comment 077 by MHoldaway

```
p. 14

  3.0-R13 Breakpoints, modifying the observing program, and dynamic scheduling may be in conflict:
  Lets say an observer says "Mosaic a 10' x 10' region to a noise level of x, and specifies a
  breakpoint to stop at noise = 2x.  When she investigates the breakpoint image, she discovers she
  should have done a 10' x 20' region to cover that ropy cloud going off the image edge.  Can she
  modify the mosaiced region?  Will it still go down to noise of x even though she is observing
  twice the sky area?
```

Reply: In that case the proposal should have said: We observe a 10' x 10' region, and after the breakpoint (defined as a noise level), we consider if the map should be extended by a factor of two in one direction'. Breakpoints do not allow extending at will the project's scope.

Comment 078 by MOhishi

```
p. 14

3.0-R12 : Is this possible for users who have poor experience on the radio observations ?  It is
  desirable that the observatory recommends some test sources.
```

Reply: Obviously. They should be standard point sources and automatic choice should be the default.

Comment 079 by CWilson

```
p 15

3.1-R8 -- unlike many of the other ASAC members, I like the idea of specifying a noise or S/N level
  for completion, as long as there is a hard limit on the total integration time. The TACs could
  still allocate by integration time, which would only be a guess anyway as the precise weather
  conditions would not be known, and any exceptional weather would be put to good use to complete as
  many projects/sources as possible.
```

Reply: We agree, and, after discussion, we agreed too that some projects (like exploratory projects) could be better specified in term of integration time.

Comment 080 by GRaffi

```
p.15

  3.1-R1 observation setup (Priority 1) I would like to increase the Priority of this to 0, as it
  seems to me an crucial component to have early. This will also define to fix early the rules for
```

scripts. Additionally I can think of a number of technical scripts to be used via the OT for high level tests of the system.

Reply: It is just the definition of priority 0 that is in question here. We restricted that to what is strictly needed to operate (or commission) the array. Any open scientific use is 1.

Comment 081 by GRaffi

p.15

3.1-R7 standard observing mode... sensible defaults I think I agree with this, but I would like to check how I understand it. The Observation Setup part of OT cannot have specific knowledge of the standard observing modes in itself and at the same time must be higher level than an editor of scripts. So I assume OT will make available Standard Scripts (or classes or templates) corresponding to the chosen Observing Mode. These will in fact be one or more concatenated default SBs, which the user will make his own by specifying his own parameters in place of the defaults he finds. Any change in Scripts will need an editor, but the OT can be used later to feed parameters into the modified SBs, if the user is accepted for interactive or manual use. My picture is that OT is an Observing Mode independent Tool and that all his knowledge is in files(scripts) providing a set of parameters (with ranges etc) to be specified by the user. Of course the user will need graphic/interactive tools for evaluating which input he should provide based e.g. on receivers/correlator characteristics. However for the dynamic scheduling observations it would be necessary that he follows a path given by default SBs, because this way the path (script) is tested and there will be no problem in executing it. So my point is that the OT used for dynamic scheduling should follow the sequence: Choice of standard observing mode->Standard scripts (meaning defaults SBs, Preamble, Postamble) and standard pipeline-> User defined parameters to be defined interactively. Advantage: this sequence is not guaranteed by the user, but by ALMA, as it is standard. So emphasis should be in filling out parameters. The OT should not in my view be a script generator, but a script browser and editor (filling in parameters) and later a script interpreter (in the run-time part). I hope this compatible with what was intended here?

Reply: The OT has to know about modes to propose observing modes for a given project. Once the mode is selected, the OT could just create a script that basically assigns values to variables the actual script would use (that's what we do at Bure).

Comment 082 by LTesti

p 15
3.1-R1 Split...

Reply: Not split (see above)

Comment 083 by LTesti

p 15
3.1-R4 ditto

Reply: ditto !

Comment 084 by LTesti

p 15
3.1-R6 dependencies: this cannot be at priority 1 and 2.2-R6 at priority 2

Reply: 3.1-R6 **is** at priority 1.

Comment 085 by LTesti

p 15

3.1-R8 sensitivity or minimum number of visibilities (for image fidelity and high dynamic range applications).

Reply: We have to find precise ways to specify minimum uv coverage for certain projects; this can be deferred for scheduler studies soon to be started.

Comment 086 by MHoldaway

```
p15
  3.1-R3 "... *that* can be directly executed"
```
Reply: OK

Comment 087 by NEvans

```
p. 15
3.1-R2 should be priority 1 to allow testing, also R6 since R7 is the
  hard part
```
Reply: Agreed.

Comment 088 by TOhnishi

```
Page15 s2.3.1

3.1-R1 The priority of the observation simulation should be higher(2) because it is quite useful for
  the people who do not have detailed knowledge of millimeter astronomy and of the ALMA software
  (same priority of those of 1.0-R1, 1.0-R4).
```
Reply: Agreed. The simulator's priority is 1 and 3, we should set it to 1 and 2.

Comment 089 by TOhnishi

```
Page15 s2.3.1

3.1-R3 I think that the "human-readable observing script" is different from the CCL and that the CCL
  interpreter converts the script into CCL language.  Then, the implementations of the script should
  be given.
```
Reply: The script is written in the CCL. We do not give implementations in this document.

Comment 090 by TOhnishi

```
Page15 s2.3.1

3.1-R8 "due to misestimated sensitivity": Although it is important to set the hard limit, the
  misestimation should be detected by the Observing Tool.
```
Reply: Well ... the misestimation could be due to an imperfect Tool implementation ...

Comment 091 by CWilson

```
p 16

3.1-R11 -- it would be good if the "real data" to be input could also be from very different
  wavelengths i.e. an optical or infrared image.
```
Reply: Agreed; but the intensity scale shall be converted before in brightness expected at the observing frequency.

Comment 092 by LTesti

```
p 16
3.1-R10 split
```
Reply: Not split (see above)

Comment 093 by LTesti

```
p 16
3.1-R11 Split
```
Reply: Not split (see above)

Comment 094 by NEvans

```
p. 16
3.1R11 should be Priority 1-3, since parts are 1
```

Reply: Agreed.

Comment 095 by CWilson

```
p 17

4.0-R3 -- I think there should be some kind of priority to finish the observations of a source with
  a single observing setup once it has been started if the weather is still good enough. If we
  switch back and forth too often between projects, the overhead could get high since every piece of
  a source observation would need a postamble, and the next piece would need an extra preamble
  observation. For example, suppose we were working at 345 GHz and the weather improved dramatically
  to 850 GHz conditions. I think it would be reasonable to finish the current source despite the
  weather improvement as long as it needed < n minutes to finish (where n would have to be
  determined, but would certainly be more than 1 minute and less than 1 hour).
```

Reply: This enters the item “Programme execution status”

Comment 096 by GHarris

```
P17

  4.0-R3 = The SB interdependency rules are nowhere stated. This is an area of policy, but a section
  should be dedicated to explaining to these rules, if we only knew what they were.

  4.0-R8 = What does it mean to run the scheduler off-line?
```

Reply: We’ll add a requirement to explain the rules we mean. We’ll explain the off-line mode better (take the weather data and other environment data from a file).

Comment 097 by JSchwarz

```
p. 17,

  4.0-R2, Execution of an SB should be interruptible by the scheduling process if, for instance, it
  exceeds its allocated time, or something else goes wrong.  What is important to note is that if it
  is later re-executed, it *cannot* be started in the middle.
```

Reply: The question whether the interruption in that case is the scheduler or the AOS or Observation Executor is up to implementation.

Comment 098 by JSchwarz

```
p. 17, 4.0-R4 & -R5,

  Why are interactive and manual modes under a "Dynamic Scheduling" heading?
```

Reply: Because it was expected to be actually handled as a “special case” of Dynamic Scheduling.

Comment 099 by JSchwarz

```
p. 17, 4.0-R7,

   What is meant by "pipeline results from the astronomical targets themselves...can be used in
   computing SB priorities" could be greatly clarified by a Use Case.
```

Reply: We meant here the test point sources; a UC for the quick Look pipeline is clearly missing.

Comment 100 by LTesti

```
p 17

4.0-R6 This is too simplicistic. Preamble and postamble may be a large fraction of the scheduling
       blocks total execution time, so the schedule should also weight this when deciding what to
```

```
do, and should check when the SB (and preamble/postamble have been observed last
time). Example:

Observing a strong source, low freq, interferometry (from app A)
  - one minute calib
  - nine minute target

(I would add another calibrator scan, by the way).  The preamble will include flux cal and
calibrator choice depending on slew times it may take 5 to 10 mins.  this 10 minutes overhead
will be repeated for each SB?  Even if contiguous? Obviously not. So the scheduler, and the
pipeline, should check for already executed pre and postamble.  Moreover the scheduler should
weight more the execution of a single project for a minimum time in order not to waist too
much time in calibrations.
```

Reply:

Comment 101 by LTesti

```
p. 17

4.0-R8 This should have priority 0, the scheduler should be already offline calibrated for use
       during phase 1.
```

Reply: Basically we'll add reference to preamble (and postamble) execution time in the factors taken into account in rating; it should be taken into account before scheduling the first block in a session. The preamble is by definition executed once in a session.

Comment 102 by MHoldaway

```
p. 17

  4.0-R2 What if the stopping criteria are to be reached in the middle of the SB?  Will the length
  of the SB be dynamically determined?
```

Reply: The SB will be able to terminate itself if the job is done, if an error is detected ... but a maximum execution time has to be checked outside for safety.

Comment 103 by MHoldaway

```
p. 17
  4.0-R3 "execution *and* the best"

  Also, a bias will need to be given to the high frequency observations; during medium conditions,
  high freq obs are precluded by high Tsys and phase noise; during good conditions, similarly rated
  low freq experiments will have lower Tsys and phase noise, and will win over the higher frequency
  experiments unless there is a bias to pick higher freq programs in spite of their lower apparent
  observing efficiency.  Similarly, there needs to be a bias towards completing partially observed
  programs over starting new programs which are slightly "more optimal" for those observing
  conditions and RA.
```

Reply: We'll add explicit reference to the stringency factor; finishing started programs is also preferred ("programme execution status").

Comment 104 by MOhishi

```
p 17

4.0-R3 : I could not find the detailed explanation for "SB interdependency rules".
```

Reply: We'll define this (see above).

Comment 105 by NEvans

```
p. 17

4.0-R3 coefficients may be subject to overall ops. policy decisions, not strictly efficiency.
```

Reply: There are a policy decisions here that will have to be stated, e.g. concerns about long-term scheduling, ...

Comment 106 by TOhnishi

```
Page17 s

4.0-R3 Observations with the same frequency may be scheduled continuously as much as possible
  because a tuning of the receiver system may take a long time.
```

Reply: The tuning is expected to be quite fast (a few seconds at most, since there are no moving parts, see the receiver specifications).

Comment 107 by TOhnishi

```
Page17

It would be nice if the allocated SBs of the next 2-3 days or the ordering of programmes according
  to scheduling probabilities are displayed somewhere and it can be accessed from anywhere.  What if
  a observation fails during the execution of an SB.
```

Reply: we'll send e-mail when a SB gets into the top 10 list; a complete list should be available to the Operator and the staff. On SB failure we do not restart right away, we wait for the cause is identified and corrected...

Comment 108 by JSchwarz

```
p. 18, 5.0-R5,

   Making the Operator Interface software available from "any" location seems somewhat rash. Maybe
   the meaning of "any" could be more narrowly defined (as in W.J. Clinton's, "It depends on what
   your meaning of 'is' is.")
```

Reply: May be any location where the Operator is supposed to be active? But we may have a read-only access mode for other places.

Comment 109 by LTesti

```
p. 18

5.0-R2 I presume that you plan also to have an automated safety system without the need of human
       intervention. Such as the wind safety system of the SEST (if wind is above limits it stows
       automatically).
```

Reply: Automatic stow is being provided by the antenna vendor

Comment 110 by MHoldaway

```
p. 18

  It seems we could say more about the operator interface OK, its my one general comment.
```

Reply: Sure we could! Here there are probably non-science requirements too.

Comment 111 by NEvans

```
p. 18
5.0-R5 better clarify "any location"
```

Reply: See above (108)

Comment 112 by CWilson

```
p 19

6.2-R1 -- would there have been instructions as to how to produce the current spectrum specified in
  phase 2 preparation? For example, a single pixel at the center of the map might not be appropriate
  for all projects ...
```

Reply: Yes! that's part of Phase II input (quality checks). The current spectrum is OK, but that may also include a position velocity map for each OTF raster, and an interim gridded image.

Comment 113 by GRaffi

```
p.19

  6.0-R2 .. readable and comprehensible data reduction scripts.  You talk here about a scripting
  language. See for that my comment on p.10 (2.2-R2). I also understand by default that you assume
  that these scripts are the responsibility of ALMA and this is why you can specify requirements. If
  it was for the users you could also make recommendations. I agree and would re-inforce this by
  saying that ALMA should provide Reduction scripts matching the Standard Observing Modes, so that
  e.g. some minimum of quality is guaranteed.
```

Reply: Of course the template scripts, both for observation and for reduction, are part of "ALMA Software", as long as they are produced by the Observing Tool.

Comment 114 by GRaffi

```
p.19

  Missing Quality checks The Pipelines should also check quality, to know that data acquired have a
  minimum of value. I would suggest to specify this and to qualify what is meant by quality checks
  for the different kinds of pipelines.

6.3-R2

  pipeline scripts .. automatically generated from templates I like this and I understand it to mean
  that there will be standard scripts corresponding to the standard observing modes. These will get
  filled out with the specific parameters of a certain observation and will be executed during the
  Postamble block.  This means that ALMA shall be responsible for creating standard pipeline scripts
  both for science data and calibrations corresponding to all the available standard observing
  modes. About the automatism of connection to the observation, I think there might be cases where
  e.g. alternative strategies can be used for calibration and so it would not be bad to apply the
  same philosophy as for the SBs, namely to let the user specify via a Browser what he wants to use,
  proposing sensible defaults. This could at least be a practical step to do in the first phases,
  where there might not be the pipeline scripts yet or one might want to try out different versions.
```

Reply: Here we should have a Quick Look pipeline UC. The same philosophy should apply to the observing scripts and to the data reduction scripts for the Pipelines.

Comment 115 by JSchwarz

```
p. 19,
first line, "between" should be "among"
```

Reply: Agreed.

Comment 116 by JSchwarz

```
p. 19,
6.0-R1, "it must not" ==> "they must not"
```

Reply: Agreed.

Comment 117 by JSchwarz

```
p. 19,
6.2-R1, "new data is taken" ==> "new data are taken"
```

Reply: Agreed.

Comment 118 by LTesti

```
p. 19

  2.6 Pipeline: A subset for offline calibration should be available in priority 0.
```

Reply: OK for off-line calibration but not for pipeline.

Comment 119 by LTesti

```
p. 19
6.0-R1 I think should be priority 0
```

Reply: 0 refers only to essential things without which meaningful data is not produced. The pipeline is thus 1.

Comment 120 by LTesti

```
p 19
6.1-R1 priority 0 (at least baseline, focus and pointing)
```

Reply: ditto

Comment 121 by LTesti

```
p 19

 6.1-R2 Priority 1 for the scheduler, priority 2 or 3 (in separate requirement) for the observing
  processes (also: dependency on 2.2-R6)
```

Reply: We disagree. We want the SB to tune its parameters, but also to be able to react if the calibrator is not detected by some antennas ...

Comment 122 by LTesti

```
p 19
6.1-R3 should be 0
```

Reply: Very important; but it is 1 like all pipelines.

Comment 123 by LTesti

```
p 19

6.2-R1 first point in priority 0 and second in priority 1
```

Reply: Should be 1 for the whole requirement.

Comment 124 by MHoldaway

```
p19

  6.1-R2 Quick look data products: I assume uncleaned images are displayed because of the need for
  something quick, & they can be constructed just by gridding and FT'ing the recently incoming data
  (and then adding, in a correctly weighted way, to the previously existing dirty image).  I would
  argue that some observations will require a deconvolved quick image.  To make it feasible may
  require quick look processing at low resolution.  Another way to help efficiency is to use the
  last quick look image to make an image plane model, subtract the model from the vis, and just
  image and deconvolve the residuals, updating the model.
```

Reply: We feel that uncleaned images are fine. They should be enough, given the good snapshot beam, to detect most data acquisition and calibration problems. We should not confuse them with deconvolution problems at that stage. Furthermore, the processing time to get the uncleaned images is small and predictable.

Comment 125 by MOhishi

```
p 19

6.0-R1 : Are we going to install the pipelines in US, Europe and Japan ?  Or is the pipeline is
  prepared only in Chile and we use the pipeline via network ?  Which do we request ?
```

Reply: Pipelines should run first of all in Chile on just acquired data and also be available in regional data centres. It does not seem that the fact to run them first in Chile is an operational issue, as there is the requirement to have a first fast feedback on the acquired observations. The pipelines are also available for re-processing in regional data centers. There could in fact be a single visible entry point for re-processing, with redirection to the nearest one.

Comment 126 by MOhishi

```
p 19

6.1-R3 : I think the poor calibration data should not be used.  Under such circumstance, I believe
  we produce only GARBAGE data.
```

Reply: That seems implied here, though not explicitly stated.

Comment 127 by NEvans

```
p. 19
6.2R2 Given number of baselines, "on-line"display of amp and phases
  will need to be creative.
```

Reply: No doubt. We may use 2d and color displays, ...

Comment 128 by TOhnishi

```
Page19 s2.6.1

6.0-R4 This is not for the Pipeline Data Processing, I think.
```

Reply: This is needed e.g. for pipeline development, and reflects the close relationship with off-line processing.

Comment 129 by CWilson

```
p 20

6.3-R3 -- why would the observer's input typically be 12 hours later?  if the observer was
  eavesdropping, the input could be as short as 1 hour; if the observer was traveling or on vacation
  (remember, he or she doesn't know exactly when the source will be observed) it could be a few
  days.
```

Reply: We feel that 12 hours is OK. We'll state:

"After a breakpoint is reached in an observing project, interim results will be produced at a high priority in less than 12 hours, allowing the observer to then select a path for program continuation."

Comment 130 by JSchwarz

```
p. 20, 6.3-R6,
   Can self-calibration really be done automatically?
```

Reply: Why not, using default input parameters? The difficult issue is may be to test automatically if self calibration is feasible.

Comment 131 by JSchwarz

```
p. 20, 6.3-R10,

   What is meant by "obtained so far?" Does this mean images in real-time?  Is this really a Quick
   Look pipeline requirement instead? Or is this the "produce 'final' image at the end of each
   Observing Session" that is in the Use Cases?
```

Reply: We'll delete the second sentence in 6.3-R10. That's the so-called 'final' image.

Comment 132 by JSchwarz

```
p. 20, 6.3-R11,

   This requirement isn't clear to me. On the one hand, the presumably automatic pipeline is
   comparing redundant data. On the other hand, these are "interactive measurements". In any case,
   I'm skeptical that this kind of feedback can be produced in near-real-time; the requirement seems
   to me somewhere between an interactive and an off-line one.
```

Reply: We'll delete the word 'interactive'. And try to clarify the text.

Comment 133 by JSchwarz

```
p. 20, 6.3-R12,

   I'm *very* doubtful that allowing "several [deconvolution] algorithms to compete" can be an
   automated, routine task of ALMA operations. This looks like an off-line job to me.
```

Reply: Delete "; it is desirable ... algorithm"; boost priority level to 1.

Comment 134 by LTesti

```
p 20
6.2-R6 split in separate requirements according to priority
```

Reply: Not split (see above)

Comment 135 by LTesti

```
p 20

6.3-R3 I do not think that it is reasonable to expect always a 12hrs reply time (but it is not very
       important, maybe you can rephrase: greater than 6-12 hrs).
```

Reply: We keep 12h; it is not the PI's response time but that's of the pipeline.

Comment 136 by LTesti

```
p 20
6.3-R4 split
```

Reply: Not split (see above)

Comment 137 by LTesti

```
p 20

6.3-R5 pipeline needs to retrieve old data check the parameters used for calibration, recalibrate if
  necessary and combine. Additional requirement is to store pipeline calibrated data (and pipeline
  details).
```

Reply: We do not store the calibrated data but the calibration data and the images.

Comment 138 by LTesti

```
p 20

6.3-R8 priority needed. I think it should be 2
```

Reply: See below; we set it to 1.

Comment 139 by MHoldaway

p 20

6.3-R6 Pipeline must also determine if self-calibration is sensible, and must automatically select control parameters.

Reply: We'll make phase self-calibration a separate requirement. (priority 2 ?)

Comment 140 by MHoldaway

p 20

6.3-R12 Deconvolution can also be under the control of the proposer, permitting algorithm selection and parameter setting.

Reply: That's should be available, while a default algorithm should be provided depending on observing mode and science parameters.

Comment 141 by MOhishi

p 20

6.3-R4 : Is this for the quick-look purpose, or for general reductions ? The priority to perform science pipeline in off-line should be raised to 1.

Reply: We maintain 2 after discussion.

Comment 142 by MOhishi

p 20

6.3-R7 : Raise the priority to 1.

Reply: We maintain 2.

Comment 143 by MOhishi

p 20

6.3-R8 : Priority is missing. Could be 1.

Reply: Agreed. Line width could determined from line extent (observer's input), a more precise determination being done automatically.

Comment 144 by MOhishi

p 20

7.0-R6 : I was so surprised to see the description - The principal archives should be easily accessed by users from Europe and USA -- . Does this mean that the users in Asia should have much lower priorities to access the archives than those in Europe and USA ?

Reply: You commented an intermediate version. We changed that in the final one to 'all ALMA partners' ...

Comment 145 by MOhishi

p 20

7.0-R10 : It is very useful to have the "Object Resolver" to convert catalog object names into celestial coordinates. See for example, http://nrodb.nro.nao.ac.jp/ .

Reply: It's a handy tool; we could also link to the CDS.

Comment 146 by NEvans

```
p. 20-21
Several upgrades to priority 1 to allow total power and short spacing
  to be included. Basically need to include TP and ACA in pipeline.
```

Reply: There should be only **one** archive entry point and search tool for all ALMA data, total power, ACA or whatever.

Comment 147 by TOhnishi

```
Page20 s2.6.3

6.3-R4 This means that all the data should be reduced by the remote computer which is probably
  prepared by ALMA group.  Does this mean that users cannot reduce the data at their local
  computers?
```

Reply: We meant here reprocessing the data using the pipeline off-line. The user may naturally reprocess the data anywhere using off line packages not in the pipeline (and not provided by ALMA).

Comment 148 by GRaffi

```
p.21

  Missing I do not find any mention of flagged data. Does this mean that these data will not be
  treated by the pipeline and/or should it be possible for the user/observer to define that they
  should get processed anyhow?
```

Reply: By default the automatic pipeline uses all flags. In off-line data processing the user may override the flags as he/she decides. We'll make this point clear.

Comment 149 by JSchwarz

```
p. 21, 6.3-R13,

   Should be combined with 6.3-R9, I think.
```

Reply: No, this is a different requirement.

Comment 150 by LTesti

```
p 21

6.3-R13 need data input from the proposer? When? P2PP? In which format?  what is "short spacings"?
        (a compact ALMA config?  then is already in 6.3-R5)
```

Reply: We meant only ALMA data, and will make it more explicit.

Comment 151 by CWilson

```
p 22

7.0-R2 -- for the radiometric path length, is it planned to archive only the derived path length, or
  the actual data from the radiometers, or both? At least in the early years of the array, we will
  probably want to archive the radiometer data, if it is not too big.
```

Reply: We feel that it's worth archiving the radiometer raw data as well (this should not increase the data rate significantly).

Comment 152 by JSchwarz

```
p. 22, 2.7

   Archiving, Is there a requirement to have a general reprocessing facility for archive data?
```

Reply: Yes, using improved pipeline software or parameters.

Comment 153 by LTesti

p 22

7.0-R1 store also pipeline calibrated data? (dependencies for 6.3-R5)

Reply: No: we store calibration data and recalibrate the uv data on the fly when needed.

Comment 154 by LTesti

p 22

7.0-R6 store also pipeline versions and input parameters.

Reply: Yes software versions in general should be there; the parameters are with the scripts.

Comment 155 by LTesti

p 22

7.0-R6 split according to priority. Second point should be priority 0. (I am a data backup maniac).

Reply: Not split (see above). I agree on that priority.

Comment 156 by LTesti

p 22

7.0-R11 Split requirement according to priority. Third should be at priority 2

Reply: Not split (see above). Agree with priority 2.

Comment 157 by RTilanus

p. 22

7.0-R3: Don't know this is such a good idea. Neither the reduction software nor the hardware will remain the same over the years. Stored images are frozen at a certain state of the art, dynamic images will reflect a mix of new software with 'old' hardware. In combination they will result in a rather 'inhomogeneous' archive.

Furthermore, with dynamic images the pipeline software will need to remain backwards compatible with the older data, conceivably over 10's of year. This will result in an increasing branching of, an increasing number of 'exception cases' within, and an increasingly unwieldy complexity of the pipeline code. It is one thing to deal with these complications offline, it is another thing to have to incorporate them into the pipeline.

On balance the added complications do not seem to justify the advantages of a 'hybrid' approach. Either only store visibilities (an then live with the complications) or add images for all observations (my choice off-hand).

Granted: I have not looked into the implications of having to store all images, but my guess is that the added volume is small in comparison with the total volume of visibilities. I may be wrong.

Reply: I think backward compatibility is a must anyway. As long as we are able to convert data in old formats to new formats, it is not a hard requirement on the analysis software.

The hybrid approach was driven by efficiency: with long baselines, the map sizes can be very big even for snapshots.

Comment 158 by GHarris

p. 24

Basic Course 5 = We have not stated the "frame set by the reviewers" and its limits. What is granted on approval? Observing time? Reduction time? Staff time? What are the allowed types of changes? Values of parameters? Observation modes? Etc. Basic Course 6 = Here is another policy issue. What do we mean by "at any time"? And does this place the data reduction facilities into

general open-ended availability? **Most of these types of statements recur in the UC, often also implying a policy. Now moving over the UC to (editor's note: missing text ?)

Reply: What is granted: see sensitivity level or maximum integration time (see Requirement 3.1-R8 and relevant comments above); allowed changes: observing modes and parameters, but not new sources, and frequencies, not lower noise level, not additional time, ...

BC 5 At any time: This is a policy issue which will come out of operational model. The other option is to allow changes only after breakpoints or only on specific authorization.

BC 6: Again this is a policy issue which will come out of operational model of data centers. There must be a limitation of course for data reprocessing there. This should be added as Issues in this UC.

Comment 159 by GRaffi

p. 24 Use Cases

I see Use Cases corresponding to functions belonging to software components to be developed. I see many others as indicating standard modes and calibrations, to be implemented via Standard Scripts. This is a work where the SSR Committee could take responsibility, once a scripting language is defined and interfaces plus a basic OT exist.

Reply: Yes but there is a close relation between OT and the standard scripts.

Comment 160 by GRaffi

p.24
ObserveWithALMA

2 dynamically scheduled .. alternatively observed interactively. I like what is implied in this, namely that in any case SBs will have been created. I imagine that in interactive mode there will be more freedom at editing them before they are run and so less certainty that there will be no quality problems with the data achieved. The fact though to start with the SBs gives everybody a minimum of discipline and people should be guided by OT in finding that the defaults proposed offer a very reasonable default pattern of SBs to start from.

Reply: OK (as stated above)

Comment 161 by GRaffi

p.24
ObserveWithALMA
4 data quality

I agree with this UseCase, where quality checks are assumed for the Calibration Pipeline and (optionally ?) for the Science Data Pipeline. There should be, as said above, also a requirement in the sections before corresponding to this. Requirements should also define the level of quality checks; I would tend to assume the minimum that ALMA means is necessary to know that data are usable and that an observation can be considered as concluded (but is it so?).

Reply: Yes

Comment 162 by JSchwarz

p. 24, Observe with ALMA: Basic Course, #2:

"Observations are scheduled in units of Scheduling Blocks." Are these the "observations" defined on p. 122?

Reply: Yes

Comment 163 by JSchwarz

p. 24, Basic Course, #4.1:
The Calibration Pipeline writes *reduced* calibration data.

Reply: Yes

Comment 164 by JSchwarz

p. 24,

Basic Course, #5, "At any time, the Observer can update the SBs..." I believe that this will be an operational nightmare (cf. experience at the VLT, where initial openness led to confusion on the mountain). I suggest that modifications be allowed only after Breakpoints or upon initiative of ALMA operations.

Reply: This is an operational issue: it's an observer's dream but not necessarily an operational nightmare. One possibility would be to allow changes by the observers: (1) at breakpoints, or (2) with a specially requested authorization by the staff person responsible of long- and/or mid-term scheduling.

Comment 165 by JSchwarz

p. 24,
"Scheduling Blocks Repository" ==> "Scheduling Block Repository"

Reply: OK

Comment 166 by JSchwarz

p. 24,
Basic Course 4.3: "Science Data Pipeline process" ==> "...processes"

Reply: OK

Comment 167 by LTesti

p 24

Unfortunately, I am very ignorant in advanced software development and do not really understand enough these cases and their dependencies. I think that priorities should be structured. Generally they look fairly well structured following the requirements above. I admit that I am confused at times if the described action is to be performed by a human or by the software.

Reply: We were too at the beginning ...

Comment 168 by MHoldaway

p 24
The word "ALMA" is sometimes not fully capitalized: "Alma".

Reply: Should be ALMA.

Comment 169 by MHoldaway

p 24
basic course 2. "The programme may have to be"

Reply: OK

Comment 170 by MHoldaway

p 24

3.1.Basic Course.4.1 "The Science Data Pipeline *processes* science data"

Reply: OK

Comment 171 by RTilanus

P. 24

UC 3.1: see point 3 above.

Reply: See the reply there.

Comment 172 by RTilanus

p. 24

UC 3.1 points 5 and 6: see point 1 above.

Reply: See the reply there on User Information.

Comment 173 by JSchwarz

p. 26,
Create Observing Programme

"It is assumed that proposals can also be submitted outside the regular proposal period." This is an operational issue, but impacts the software if, for example proposers must all use the same version of the tool. Most observatories issue periodic calls for proposals for good reasons: proposal conditions and policies may change, certain configurations and instruments become available and some not, etc. The sentence should be deleted.

Reply: Agreed.

Comment 174 by MOhishi

p 26
Create Observing Programme :

In Basic Course, item 8. Add, "Alternate case : Observer retrieves a previously (locally) stored SB for reference." This is to be consistent with UC Create/Edit Scheduling Blocks.

Reply: No; we should keep the level 1 UCs rather simple and put the details at level 2 like UC Create/Edit Scheduling Blocks.

Comment 175 by NEvans

p. 26-27

It is important to be able to retrieve and resubmit up to the deadline, not only locally, but also on the server. This seems possible based on pg. 33, but should clarify here.

Reply: OK

Comment 176 by TOhnishi

Page 26 s3.2.1
Preconditions 1

In case that the Observing Tool is locally installed, it would be nice if the Tool checks the most recent version via network and notify the user. The expected data quality and hardware limitations will change frequently (3.0-R8).

Reply: Preconditions means some facility has to be provided to do this check; having the tool check it itself is probably the best solution (as proposed in Analysis Document Draft).

Comment 177 by GRaffi

p.27

Notes Phase I validation is reasonably light.. most basic instrument settings. Fine, compatibly with the little input OT will have received in Phase I. In any case one will need to specify what this validation can be in more detail.

Reply: Yes

Comment 178 by JSchwarz

p. 27,

"Reviewer evaluates (incl. feasibility)..." Most reviewers do *not* evaluate feasibility.

Reply: Should reviewers be reviewed ?
We should have a technical review stage first.

Comment 179 by JSchwarz

p. 27,

Notes: "Passing the validation means that the Scheduling Blocks can be executed at ALMA without problems." I can't imagine any validation process, certainly not a computerized one, that could provide such a guarantee.

Reply: We cannot be a 100% sure. Let's replace 'can' by 'should'. The best way to check is to have a real Simulator.

Comment 180 by JSchwarz

p. 27,

"The observer shall be informed..." should be in the Basic Course (the part after review, #7, is there already)

Reply: OK

Comment 181 by JSchwarz

p. 27,

"Scheduling Blocks can be revised..." As noted above, I think this is asking for trouble.

Reply: See above.

Comment 182 by JSchwarz

p. 27,

#8: First sub-item should read: "The tool creates Phase II Scheduling Blocks, and the user may optionally define breakpoints..."

Reply: OK but drop the 'may' or the 'optionally'.

Comment 183 by JSchwarz

p. 27,

Issues, #2 should read: "...guarantee a minimum...which depends...observing time granted"

Reply: OK

Comment 184 by JSchwarz

p. 27, Many more typos on this page.

Reply: OK

Comment 185 by MHoldaway

p 27

Basic course.6 Should ALMA proposals be firmly rejected, or just rated, with the highly rated proposals floating to the top of the queue?

Post conditions.1 With dynamic scheduling, time allocation is not absolute for moderately rated proposals.

>>> I am so glad I don't have to write these comments in German or
>>> French. Thanks to all who had to write in a non-native
>>> language.

Reply: Fully agreed. Firm rejection should be only for totally infeasible (hardware unavailable), or really bad proposals. What really matters is a ranking.

Comment 186 by NEvans

p. 27
Lots of issues here. It is clear that it is time to start to define some of the proposal policies

Reply: Fully agreed!

Comment 187 by CWilson

```
p 29

Use Case: Create Observing Programme -- the proposal tool and observing tool must be easy to install
  as well as use and must be supported under numerous operating systems. It must be better than the
  current Gemini/GBT tool, about which I have heard several complaints. Would it be possible to have
  a LaTeX or html script that could be editable as backup?

  Regarding the format for attaching the scientific justification, it must be something that lets
  you do equations properly. It must also be something standard enough that the referees in Europe,
  Japan, and North America can read and print it regardless of whether the document was prepared on
  a P.C. or a workstation. (For example, I have had problems reading and/or printing postscript
  documents created on a PC from a workstation; I have had problems printing out PDF files created
  in Japan.)

  Technical reviewers might not be necessary for straightforward proposals if a good
  simulation/noise estimation tool is available. (My experience with the JCMT is that the technical
  reviewing is no longer necessary for straightforward proposals, as the scientific referee can
  double-check their numbers using the on-line integration time estimator.)
```

Reply: Having only a latex file (not the tool) would mean too much staff load, I think.

My feeling is that for the Scientific Justification the text processing tools used for scientific publications should be usable.

I agree on your last point.

Comment 188 by DGRoh

```
p.29 3.2.2
  "Proposal Tool" should provide

   - Line catalog with standard transition names

   - Calibrator catalog with all (or a few recent) flux measurement history with ALMA. Integrated or
     separated GUI tool with such catalog would be helpful for selecting calibrators quickly and
     properly(nearer and stronger).

   - Previously observed source list with short information.  source name and position,
     obs. frequency, obs. date, data quality(S/N and rms; or very good, good, medium, poor, very
     poor), and data status(in public, published, in processing, etc)

   These will help the Observer to select his/her sources and calibrators, and to refine his/her
   proposal much better.
```

Reply: We have include line catalogs in the requirements.

For calibrators the best choice is to be left to ALMA, the expert user should rather concentrate on a choice algorithm.

What do you mean by 'previously observed'? by the same observer? in a related proposal ?

Comment 189 by JSchwarz

```
p. 29,

Create/Edit Phase I Observing Proposal, Basic Course, #5: Perhaps the tool itself suggests what
   observing mode to use, based on the proposer's goals (angular resolution, field size...)
```

Reply:

Comment 190 by JSchwarz

```
p. 29,

   #6: Under what circumstances can the SNR, as opposed to the noise error, be specified?
```

Reply: For some programs the goals may be stated in terms of SNR: absorption measurements, position measurements ... If the source flux increases by a factor of two you only need a fourth of the time.

Comment 191 by MOhishi

```
p 29
Create/Edit Phase I Observing Proposal :

In Basic Course, item 8.  Do we need a function to include other files which contain scientific
  justification ?

In Issues to be Determined or Resolved.  The proposal Tool should have a least ... . -> at least.

In Notes, item 2.  At any time the Observing .. -> Observer.  Item 5.  the Observer can saved ->
save.  Item 7.  I suggest that the files names ...  -> the file name.
```

Reply: Do you mean figures? tables ? yes. Correct the typos.

Comment 192 by NEvans

```
p. 29

Basic course 4. should have data base of user info so we don't have to enter these things every
  time. Of course need to be able to update, with password.
```

Reply: May be ... We'll add a note in this UC.

Comment 193 by NEvans

```
p. 29

for mosaics, need help to set up grid. This is implied later, but not here.
```

Reply: The explicit grid should not be required at Phase I, only at Phase II.

Comment 194 by TOhnishi

```
Page 29 s3.2.2

Basic Course 6-2 The conversion from experienced to novice may lost some information that is set by
  the experienced mode.
```

Reply: It's the opposite conversion that is done here.

Comment 195 by MHoldaway

```
p 30

  Issues TBD "corrector setup" ==> "correlator setup" "This user" ==> "The user"

  Notes (Proposal may) "parameter" ==> "parameters."

  Notes(At any time) "Observing" ==> "Observer"

  Notes(At any tme during) "saved" ==> "save"

  Notes("It has to") "...which formats for the scientific..."

  Notes("I suggest") this should be rewritten (ie, no "I"); at the least, "files" ==> "file"
```

Reply: OK

Comment 196 by NEvans

```
p. 30

Notes There may be a hierarchy within a proposal. One might want to do, say 3 objects, each with a
  different observing plan. Needs thought about how to organize. It would be good to have the
  archived proposal downloadable in various forms, as in astro-ph.
```

Reply: This will be a complex or composite programme, with say 3 SBs or 3 SB groups, with dependency rules ...

Comment 197 by JSchwarz

```
p. 31,
Validate Observing Programme

   I think that this Use Case needs to specify what is going to be validated (syntax, feasibility,
   declinations between -90 and +90, ...)  or should be eliminated entirely.  "...about 2000
   proposals are expected for each submission period."  Without even knowing how long these periods
   are, how can we make such an estimate?
```

Reply: This number is a rough guess I think. A number is needed to estimate storage areas ... etc. Validation here should be at the level of user input for each mode and at the level of the script (may not be necessary if a standard mode is used hence a checked script).

Comment 198 by MHoldaway

```
p 31
  (Frequency) "Locally_, " ==> "Locally, "

 (Preconditions.3) "network connected" ==> "network connection"

 (Basic Course 3&4) "see UC Phase I Validation" !! This is self referential, as that is THIS UC!
```

Reply: OK [I think I messed up these internal references when producing the pdf file].

Comment 199 by MOhishi

```
p 31
Validate Phase I Observing Proposal :
In Preconditions.  Item 1.  .. is request ..  -> is requested

In Basic Course.  Item 2.  It would be better to include other quantities, such as sensitivity (S/N,
  rms, dynamic range, etc.)  Item 4 says not to inform observers.  But I believe it is better to
  inform observers if they hope to merge their proposal or not.
```

Reply: Last point is actually in the Subflow. The proposer should be warned if there is overlap with a project already done, even if the sensitivity goals are different. If there is an overlap with another proposal in the same period, then the observer should not be warned, but the PC should be. Then it's up to the PC to propose a merge (issue 4). I think that subflow is OK.

Comment 200 by JSchwarz

```
p. 32,

   "The validator checks ... completeness ...Graphs and figures included." Graphs and figures aren't
   required, are they?  How/why should you check for them?
```

Reply: The question here is: either we get one or more pdf or ps files. Then there is no way to check for integrity (ask for the number of pages ?). Or we use a specific system like Latex; for this at IRAM we ask the user to tar a number of files (sources and ps figures). At IRAM the validation untars, runs latex and produces a ps file. If latex fails, the user is informed that (s)he did wrong.

Comment 201 by MHoldaway

```
p 32

  (Issues to be Determined) What specifications are checked by the validator?

  (Issues to be...  5) Just my comment: If we allow the software to prevent submission, we are
  saying we have absolute faith in the software's ability to determine if programs are really
  overlapping.  Many overlapping programs may not be so obvious.  I say, let 'em through.
```

Reply: We say we let them through (not clearly enough). There is only a warning in case of overlap with already done things and a flag to the PC.

Comment 202 by NEvans

```
p. 32

Many tricky policy issues. In general, I think one should be alerted to overlap with existing data
  and allowed to change up to deadline. Overlap with submitted proposals is a different matter.
```

Reply: Agreed.

Comment 203 by MOhishi

```
p 33
Submit Phase I Observing Proposal :

  In Issues to be Determined or Resolved.  I am afraid that I could not understand item 1.
```

Reply: We'll take it out (see above).

Comment 204 by TOhnishi

```
Page 33 s3.2.4

Basic Course 4 It would be nice if the submitted proposal can be obtained from the ALMA Proposal
  Repository under the user identification in order to check it after the submission and to modify
  it.  The storage system like Yahoo would be nice.
```

Reply: That would rather affect Precondition 2 in Create/Edit Phase I Observing Proposal (p 29), which states that the previous state should be available locally.

Comment 205 by MHoldaway

```
p 35
  Preconditions 1: capitalize Proposal

  Basic Course 3: possible

  Basic Course 5: Alternate course: Reviewer

  Basic Course 6: Where are the policies for rating to be made?  While that is clearly out of the
  scope of the SSR, there are certain items which we do need to address, such as a high frequency
  bias (see earlier comments).
```

Reply: OK; policies for rating: we have stated in the requirements the minimum, which I could restate as: after a full scheduling period, the lowest ranked programmes actually done have about the same science rating in each range of scheduling conditions. Obviously this cannot be exactly done, so to achieve that approximately one will have to tune some factors to e.g. enable low frequency programmes to be done even if the weather is always good for submm work ...

Comment 206 by MHoldaway

```
p 35: Policy Issue  "Does the whole...."

  "It is assumed...:

  OPCL The excellent -- poor observing conditions will show unexpected and exceptional variations,
  so we cannot count on history repeating itself.  Sometimes, we will get exceptional weather, and
  it would be bad to have rejected too many proposals at high frequency because we didn't expect
  that.  Likewise, if we get really bad weather, the array will sit idle if we don't have enough bad
  weather programs.

  To repeat myself: proposal rejection need not occur, or perhaps only for the really bad programs.
  The priority, needs of the program, and the weather will conspire to select the programs which are
  observed.
```

Reply: OK; We fully support this point of view. The same applies for low frequency proposals if the weather is too bad.

Comment 207 by MOhishi

```
p 35
Review Phase I Observing Proposal :

  In Preconditions.  Insert an "is" between "Reviewer" and "assigned".  In Issues to be Determined
  or Resolved. How many reviewers are planned to be assigned for a proposal ?
```

Reply: OK. Requirement: "The reviewers shall be positive (at least in number)" (well this is a policy issue, not for us to decide).

Comment 208 by NEvans

p. 35

reviewer should not have burden of checking overlap or technical feasibility. The "stringency" defined above should also be calculated by the software for the reviewer to consider.

Reply: Overlap no; Technical feasibility need not be checked manually for standard modes. The stringency factor should be computed for known weather statistics, foreseen configuration schedule, and technical availability e.g. of receivers. But it is only indicative, since there is some freedom in the long-term scheduling, and the weather cannot be safely predicted.

Comment 209 by NEvans

p. 36
Policy It should be possible for the reviewer to assign
different priorities to different parts of proposals.

Reply: If you say so. However it introduces more complexity in the scheduling. May be should we collect more opinions on this point.

Comment 210 by GRaffi

p.37

6 .. Observer might create a separate Preamble. Should we not say that there is always at least one Preamble and Postamble Block, which deal with Initial and Final operations (calibrations, kick off of Pipeline etc). At worse they can be empty. These terms: Preamble and Postamble Block should also go into the Glossary.

Reply: We'll add these terms.

Comment 211 by JSchwarz

p. 37, Create/Edit Scheduling Blocks, Basic Course #6:

Preambles are intended to be a normal part of operations, not produced only "in the case of special, non-standard observing requirements".

Reply: Agreed.

Comment 212 by JSchwarz

p. 37,
Basic Course, #2 "granted," ==> "granted time,"
#4: "reconfigured templates" ==> "preconfigured templates"

Reply: OK

Comment 213 by MHoldaway

p 37:

introduction: "On-line access to ... manuals and tools for observing simulation in desirable."

Reply: OK

Comment 214 by MHoldaway

p 37

General I am pretty disappointed with the direction the SB schedules has taken. My initial idea was to tell the ALMA system something really simple, like:

Mosaic the 10' square field about position RA DEC with x resolution and sensitivity to structure of y and smaller, at frequency f; and calibrate to yield xx degree phase errors.

I suppose this is seen to be too difficult, or to leave the expert user with too little to do? Or is this what is meant by novice mode?

Reply: Basically, reading this again, I agree with you. A lot of things are hidden in BC 4-5 of this Use Case, which should be more explicit, since that's where high level science parameters are entered (or taken from Phase I), and where all the branching into the Observing Modes Use Cases occurs.

Comment 215 by MOhishi

```
p 37
Create/Edit Scheduling Blocks:

  First of all this UC should be in consistent with UC Create Observing Programme.
  In Basic Course, item 2.  Phase 1 -> Phase I.
  Item 4.  Don't we need the expert mode ?
  Item 5, subitem 7.  image dynamic range ?
  In Issues to be Determined or Resolved.  Item 4.  Authentication of users is VERY important.
```

Reply: OK

Comment 216 by NEvans

```
p. 37
BC 5.8 Seeing (rms phase) should be additional requirement, but
  must be consistent with proposal and review.
```

Reply: OK. This should be taken from Phase I

Comment 217 by RTilanus

```
p. 37

UC 3.2.6: see point 2 above.
```

Reply: OK

Comment 218 by JSchwarz

```
p. 38,
Issues:
   Again, I think that submitted SBs *should* be "read-only".
```

Reply: They can't be always, as we allow break points. However the default should be that they are read-only. Whatever changes get done at break points must be consistent with Phase I (at least source and frequency should be checked). Given that the degree of changes allowed is a Policy Issue, it would be better that the software is capable of dealing with changes and then the extent of them will be defined with the policy definition.

Comment 219 by MHoldaway

```
p 38

  Issues: Scheduling Blocks -- I think this is redundant and can be removed (or most of it anyway).
```

Reply: Yes, it is said in the Basic Courses.

Comment 220 by MHoldaway

```
p 38
  General:

  Presumably we need to create reduction scripts to go along with the SB's.  I argue that many SB's
  are simple enough that we need only provide the role of the various sources (phase cal, target).
  The alternative to that would be to include template reduction scripts in the SB generation
  process.

  Certainly there will be cases when expert reduction scripts are created, and yes, they must be
  verified, at least to some rough level.  (Complete verification would probably require running the
  reduction programs, and may not be feasible.)
```

Reply: I think the solution is standard reduction scripts, that find their parameters in the data headers, or compute them from the data headers. That's what we do for a standard calibration script at Bure. Complete verification would be feasible if we develop a full scale simulator.

Comment 221 by NEvans

```
p. 38
I think the simulator is quite important.
```

Reply: Yes it is.

Comment 222 by JSchwarz

```
p. 39-40,
Validate Scheduling Blocks

   What does it mean to say, for example, that the validator will check the Observing Mode? See
   comment about Validate Observing Programme.
```

Reply: There are too many items here.

Comment 223 by MHoldaway

```
p 39
  Introduction: "specifications"

  Frequency: "Locally_," ==> "Locally,"

  Preconditions 2: "a new"

  Basic Course 4: "System starts"
```

Reply: OK

Comment 224 by MOhishi

```
p 39
Validate Scheduling Blocks:

  In Issues to be Determined or Resolved.  Item 1.  What does we .. -> What do we ...
```

Reply: OK

Comment 225 by NEvans

```
p. 39-40

checks must include consistency with the proposal and TAC approval, so need check of both input
  (vs. approved stringency) and output (for technical compatibility).
```

Reply: 'approved stringency' is difficult to define. But you're right.

Comment 226 by GRaffi

```
p.40

  Issues 1. validate Phase II input or output (possibly modified) observing script I would suggest
  that this is a practical and not policy question. My guess is that for standard modes (used as
  such in dynamic scheduling, if I got it right) it is enough to validate input parameters, because
  the standard scripts have already been tested.  In interactive mode scripts are not tested. My
  suggestion here is that we should assume that interactive users are required to do some (partial)
  tests on a simulator before using ALMA to debug their scripts (no matter if it is their own time
  this should be seen as an unacceptable waste, when one deals with non-standard scripts meant just
  for one user).
```

Reply: I agreed with you, for standard modes only the input needs to be checked. This is also valid for interactive mode, using standard scripts. Non standard scripts could be checked against a simulator if feasible, particularly if big changes are being made and if a lot of observing time is involved.

Comment 227 by GRaffi

```
p.40

  Issues 1. validate.  On the subject of validation though I would imagine that it is important to
  validate observations as well. For example it should be clear that the program is complete and
  there are calibrations to enable the Pipeline reductions.
```

Reply: Yes; but that comes later ?

Comment 228 by MHoldaway

p 40
Issues 1 "What do we actually.."

2 I would vote for threat of a personal audit.

Reply: OK.

Comment 229 by MHoldaway

p 41

General: We need to somehow make sure that the SB is checked in well in advance of when it is required for the potential observations.

Reply: For operational reasons there should be a Phase II deadline, before the end of the previous period. The motivation is to have most of the information that affects the scheduling some time in advance, to be able to react on the mid-term schedule (array configurations).
However changes must be allowed after breakpoints.

Comment 230 by NEvans

p. 41

Tricky point about whether you can submit SBs piecemeal. Again may need a hierarchy.

Reply: The tool can check a SB will be testing the execution of other SB's that have not yet been submitted and issue a warning, until the programme is complete (no virtual SBs).

Comment 231 by JSchwarz

pp. 42-43,
Schedule SB

Several non-existent Use Cases are referred to (e.g., UploadSBMenu, DisplaySBMenu). Even if they did exist, I don't think they would add much to our understanding of the requirements, so I think that all references to them can safely be eliminated.

Reply: These references will be deleted.

Comment 232 by JSchwarz

p. 43,
#6:

"System updates status of executed SB menu..." I think that it is the status of the Observing Programme and SB itself that gets updated.

Reply: Yes.

Comment 233 by MHoldaway

p 43

Basic Course 5: comment: We will seldom get into a situation that sources are below the horizon, as the penalty for low elevation observing (ie, higher system noise, etc) coupled with the general lack of need for long tracks to fill in the (u,v) coverage will tend to make an SB centered on a different RA more attractive long before the initial SB's sources have set.

Also, there will need to be a database that keeps track of all active SB's, what noise level they are down to, how much time they've been observed for. Some of this information is at the program level, so its unclear to me exactly what and where this information is kept. I guess the programs keep info like "Max time permitted". The AOS could keep a database of pointers to active programs, and the programs themselves could know about how long they've been observed... I guess I am into implementation know though.

Issues: While the set of rules for priorities is premature, we should have a plan for how we come up with these rules. I suspect we'll have preliminary rules in a few years (ie, as a placeholder which will provide to the rest of the system the form which the rules will take), but the rules will evolve extensively in the first couple of years of ALMA operation.

Reply: This only refers to the rare case when the scheduler runs out of SBs, e.g. no sources at all are visible, among those in Schedulable SBs.

All the info you refer too is kept in the SB repository. Such information is outlined in the Appendix on Observing Objects.
We should not wait for a few years but start scheduler studies using simulated programmes and actual weather data.

Comment 234 by NEvans

```
p. 43
Issues  again it is clear that we need some progress on policies.
```

Reply: Yes

Comment 235 by JSchwarz

```
p. 44,
Execute SB

   "SBs are the smallest units that the Dynamic Scheduler considers when calculating priorities..."
   The smallest unit might include Preamble and Postamble as well, since they impact the time
   required for the SB if it's the first in a Session.
```

Reply: Should be 'the smaller units to which the scheduler assigns priorities'. Pre- and postambles are to be considered since they affect the total execution time of a session.

Comment 236 by JSchwarz

```
p. 44,

Basic Course 2.1: Allocating resources should be done before the SB is sent for execution; that way,
   the AOS will only have to deal with SBs for which the resources are guaranteed. This can also
   simplify the scheduling (see the preliminary software analysis document).
```

Reply: Yes

Comment 237 by JSchwarz

```
p. 44,

   #5: "standard observations": I doubt that "observation" is used here in the sense in which it is
   defined on p. 122. This ambiguity occurs again and again, and its presence argues for changing
   the term denoting part of a scan to something other than "observation".
```

Reply: Should be 'standard observing modes'. Having given a precise meaning to 'observation' forces us to use the right term here rather than 'observation' as a vague container for anything!

Comment 238 by LTesti

```
p.44
Use Case Execute SB

   This looks like a nice place to add at the end (I am not really sure where) "send e-mail to
   proposer informing that his/her project SB has been executed" and, if appropriate, "send: your
   project has been completed!  Write the paper!"
```

Reply: Should not be done on every SB (that's too often) but only after the first and last one in a session.

Comment 239 by MHoldaway

```
p 44

  Basic Course 2, 8 the substructure might be a., b., c., instead of 1., 2...
```

Reply: Remember we're using html.

Comment 240 by MOhishi

p 44
Execute Scheduling Blocks:

It is not described how we can satisfy the scientific request 2.1-R7 that we need to run sub-arrays simultaneously.

Reply: All this is supposed to run as a session; there may be parallel sessions using other operation modes than dynamically scheduled.

Comment 241 by GRaffi

p.45

Should interactive observing be setup via SBs and go through the scheduler or rather use GUI. My preference, which I believe is compatible with the required freedom, is that there should always be SBs, but they have not to be based on standard scripts, but on modified scripts. I do not know if the Scheduler should see these blocks, but I understand the user has to be free to schedule them as he wishes. Everybody then should use the OT GUI before run-time to edit parameters and at run-time to run SBs (no matter if they are standard or not).

Reply: This has been agreed (see above).

Comment 242 by MHoldaway

p 46
Preconditions 2, and Basic Course 2

It seems to me that most observing will not require a special script to process the calibrations, and there should be a default action that takes place. To do this, the SB needs to label the intent of each source observed (ie, polarization PA calibrator, phase calibrator, etc).

Also, we need not process the calibrator data cumulatively, just incrementally; though one can conceive of algorithms that are non-local in time, using much data from other times to solve for each time solution. Maybe we need an incremental- cumulative processing switch.

Reply: Point 1: this is intended (see above).
Point 2: you're right; there is a preference for algorithms for which observation of a calibrator affects only the last few calibration intervals.

Comment 243 by MOhishi

p 46
Process Calibrations:

In the Preconditions, it says that the data is available from the Correlator and Total Power detectors. However, I think the data are already sent to the archive. Therefore this item maybe read like "Data is available in the Calibration archive, or the Raw Data archive". In Issues to be Determined or Resolved. What is the ACS ?

Reply: You're right, though it may be more efficient here to work with temporary in line storage. ACS is probably a typo for AOS.

Comment 244 by GRaffi

p.47

How ACS (?) and the Scheduler retrieve Pipeline results? This can be sorted out at design time. However I would like to know what results you have in mind. Is it simply a flag (quality OK/not OK) or is it more... but then why should the scheduler need more?

Reply: It's more than that, it includes some parameters like pointing constants, antenna coordinates, ...

Comment 245 by JSchwarz

p. 47,

Process Calibrations, Notes, #2: What is to be done with the unfinished calibration reduction of the previous session if the current session has priority for allocation of computing resources? If the *requirement* is for pipeline processing not to be a bottleneck, then this statement is unnecessary. If it implies that not all sessions are of equal value...?

Reply: There is a priority issue here; calibration of current session is more important than any calibration or imaging of the previous one since the feedback time here is a few seconds while for imaging it's 12 hours. This is more constraining than the general 'no-bottleneck' requirement.

Comment 246 by GRaffi

p.48

3. Programme dependent reduction scripts are available: I would prefer to say that ALMA Standard reduction scripts shall be available and used, matching the standard observing mode chosen. In interactive mode there might be the problem that standard pipelines might not work, depending on how much standard SBs were messed up. The problem will be here to see that users check SBs and reduction scripts in simulation, but we can imagine any variety of alternate courses when things go wrong. In one word quality of final data cannot be guaranteed in interactive mode.

Reply: The scripts are generally programme dependent though in most cases they are only observing mode dependent. SBs are not necesserally messed up in interactive mode.

Comment 247 by JSchwarz

p. 48, Process Science Data, Basic Course, #2:

"...executes reduction script commands whenever observations are written into the archive..." The introduction to this Use Case says--much more reasonably, I think--"Science data processing will at least take place after each SB...and eventually at the end of the Observing Session."

Reply: You're right. I've mixed up the Quick look and the Science data pipelines.

Comment 248 by MHoldaway

p 48

introduction As stated in comments made in 2000: it is pretty straightforward to convert the incremental images into a coadded cumulative image. The computation is minimal.

preconditions 3 Again, many observing programs will be simple enough to not require any reduction scripts.

Reply: OK; but th incremental image is made by the Quick look pipeline.

Comment 249 by MOhishi

p 48
Process Science Data:

In the Preconditions, it says that the data is available from the Correlator and Total Power detectors. However, I think the data are already sent to the archive. Therefore this item maybe read like "Data is available in the Science archive, or the Raw Data archive".

Reply: Same answer as above.

Comment 250 by RTilanus

p. 48

UC 3.5.2 "Postconditions point 3": The Scheduler UC does not make mention of this (see also next point same page). Also, what kind of information will be fed back? I do not object to the capability, but if one expects that some critical aspect of the real-time operation will rely on this, it should be identified. I.e. I am assuming that in principle the scheduler will work with expected rms levels attained based on conditions during the observations rather than on measurements of this rms from the data (a possible future upgrade as well is measuring the actual S/N -- dangerous since it relies on our expectation of what the data will look like --).

In any event, if no critical feedback at present has been identified, perhaps this should be labeled as 'for future developments'

Reply: We're thinking of quality checks for test sources. That's in the requirements (priority 3) for test sources. It's true that the ScheduleSB should mention this.

Comment 251 by JSchwarz

p. 50,
Manage Archive, Performance:

The Archive must be able to cope with *peak* data rates of ~60 Mbytes/sec, but the average should be 10 times lower. This is important for the size of the Archive.

Reply: Yes, add the average rate.

Comment 252 by MHoldaway

p 50
introduction:

Environmental data: I am assuming "instrument status" refers to the explicitly astronomical instruments on the telescope. So, I would include the phase monitoring and opacity measures here as Environmental data.

Reply: This should be more explicitly stated.

Comment 253 by MHoldaway

p 51
Issues:

my opinion: I would set up two archives, one for raw or calibrated data, the other for reduction products. The data archive could actually be ordered in time. The image archive would not, as some images might not be made in their full glory for weeks or years after observations (ie, the images would not be archived in the order in which they were observed, and won't be right next to the data from which they were generated). Each of the two archives would be more homogeneous in data type than if combined into a single archive.

I would argue that if two archives were made, the processing scripts should be archived with both the data (ie, initial scripts) and the images (perhaps more refined scripts). In the latter case, you'd also need some pointer to the raw or calibrated data archive.

Reply: All this is implementation detail, as we say.

Comment 254 by NEvans

p. 51
The observer must be notified as well.

Reply: I'm not sure. In that case I suppose the data are still somewhere on a temporary medium; they are not lost but may be the system has to do something. The observer can't do anything (but get stressed ...

Comment 255 by JSchwarz

p. 52,

Retrieve Archived Data, Introduction: "...optionally reduce it using the Science Data Pipeline..." I couldn't find this in the numbered requirements list.

Reply: 6.3-R4; 7.0-R11

Comment 256 by NEvans

p. 53

Interesting issue of access to computing resources. Probably will depend on RDC.

Reply: There should be a policy statement on that point. This reprocessing is likely to be done at the regional data centers. We may need about 1/3 of the computing resources of the Chile processing computers at each regional data center.

Comment 257 by DGRoh

p.54-p.82 3.7

While making a interferometric observation, one(or more) separated antenna could be used for total power observation. I suggest to let ALMA have a DEFAULT observation mode; in which mode, an antenna measures the total power mapping in on-the-fly/position-switching/ frequency-switching,

```
and all the others are used in usual interferometric observation of
single-field/multi-field/on-the-fly mode.
```

Reply: This should be part of a general science plan. The single dish work is likely to be done by ACA, I guess.

Comment 258 by MHoldaway

```
p 54
  General Comment:

  I don't see an explicit connection between the Observing Programme/Schedule Block stuff and the
  Observing Modes like SettupSingleField.

  This sounds more like what I want to happen in that the user specifies higher level quantities.

  Basic Course 2.alternate course: "is different from..."
```

Reply: The detailed connection is missing; it could be explicited in Create/Edit Scheduling Blocks UC. We have taken the approach to do the observing modes in parallel because we felt it helped the analysis (they felt it useful).

Comment 259 by MOhishi

```
p 54
Setup Single Field:

  I didn't quite understand of this use case is performed as a part of preparation of the Phase II
  observing proposal.  Maybe I am wrong, but I think we need to provide users templates for this use
  case.  This is because Observing Tool should be able to contain these parameters, and some
  observers are not familiar with the interferometer observations.  And I think we need to consider
  how we treat the path length correction in this use case.  In Basic Course, Item 6.  It would be
  better to input frequency bandwidths and frequency resolutions for, e.g., molecular line survey
  projects.
```

Reply: Path length correction: BC 9.

See above (258) for the missing link with Phase II.

Comment 260 by MHoldaway

```
p 55

  Basic Course 7/8: The user should generally not need to know about the specifics of what sort of
  calibrator choice policy or frequency.  These will vary with observing frequency, and it should be
  part of the Observatory's service to determine what is optimal.

  Basic Course, 12: Total time: presumably, the referees have specified a total maximum time for the
  entire programme; how does that relate to the total time here?

  general: From this, it sounds like the SB's are generated automatically, while the Create SB user
  case sounds like the user must create them in great detail. (??)
```

Reply: BC 7/8: This should be hidden from the general user, but accessible to the expert ?

BC 12: if there is a single target in this mode: that time is the same value; otherwise all maximum times times should add up to less than the overall limit stated by the reviewers.

As I said above, the CreateSB needs to be updated to be really compatible with these observing modes UCs.

Comment 261 by NEvans

```
p. 55

BC2.7 Gets to issue of choosing calibrators. This method may be OK, but a continuously updated
  library of calibrators should be searched at observe time.
```

Reply: Yes: BC2.7 describes th emothod used at observing time; see also the Gain Calibration UCs

Comment 262 by NEvans

p. 55
BC2.13.7 "at least" one SB/config.

Reply: Yes, only one for each independent target in this mode.

Comment 263 by MHoldaway

p 56

Basic Course 6: In addition to flux, the shape of the visibility curve is important in assessing the viability of a calibrator.

Reply: Well, I assumed all would be point sources. That's OK for the strongest ones in mm and submm band.

Comment 264 by MOhishi

p 56

Observe Single Field: In Basic Course, Item 1, sub item 2. I believe the frequency separation between the target and calibration is close. This is especially important for the submm observations because the atmospheric opacity changes dramatically as a function of frequency. Item2, sub item 1, line 1. is larger that -> is larger than.

Reply: No, they are far apart; but only the phase is transferred from calib. frequency to target frequency.

Comment 265 by TOhnishi

Page 56

The difference between SB and Observing Session is not clear for me. Which is the smallest unit that cannot be interrupted by the scheduler? It is to be specified how the Observing Session is created from SBs.

Reply: That's the SB definition. The observing session is *de facto* created when SBs (in the same group) are executed in sequence.

Comment 266 by NEvans

p. 57

Issue 7 this is thorny. Best not to waste time on postambles if other sources could be done, but also don't want to jeopardize completed observations. Will need to be flexible to allow policies to evolve.

Reply: We would rather start and finish the phase calibration in the SB itself, the first phase cal being optional. It makes things simpler.

Comment 267 by MOhishi

p 58
Reduce Single Field:

Top line. Reduction operations fspecific to ... -> specific. In Basic Course, item 1. Don't we need to use model atmosphere data to make the calibration more accurate ?

Reply: OK; Yes on second point (this is more explicit in UC TemperatureScaleCalibration (which should be referenced here).

Comment 268 by GRaffi

p.60

Multi Field .. usually multiple SBs I assume they will be sequential, but could they also be parallel in that one covers a part of the antennas/mosaic and one covers another part? The latter would have quite some impact on the way SBs work.

Reply: multiple SBs are not needed, that depends on the number of fields.

Comment 269 by MHoldaway

p 60-62
general:

It seems that the bulk of the SingleField and the MultiField setups are common, and should be broken off into a "CommonSetup" use case. Object Oriented and all. The same is true of Observing and Reducing Use Cases. Reproducing the redundant info in all the observing modes makes them boring to read, and the material is less likely to be read than if just the differences were noted in each observing mode.

Reply: That's true; we have to go into this factorization effort. But may be it's the work of the analysis group ?

Comment 270 by MOhishi

p 60

Setup Multi Field: In Basic Course, item 2. I think position angle is an other necessary info. Between Item 25 and 26. Insert "User may either refine the pipeline reduction script parameters, modify the parameters, or accept the setup." In Issues to be Determined or Resolved. I think we need a rule to give the setup a unique name.

Reply: Position angle, as all geometric parameters.
That naming is an implementation issue.

Comment 271 by NEvans

p. 60-62
MultiField setup.

In general the description here is very good and the single field descriptions should be made compatible, where sensible to do so. For example, the ability to save a partial setup.

Reply: Yes, but we should factor out the common parts.

Comment 272 by NEvans

p. 63 OTF mosaic.

It should be made more clear that this is in interferometer mode.

Reply: This is not OTF Mosaic, and interferometer mode is mentioned in introduction.

Comment 273 by GRaffi

p.65
Preconditions:
A data reduction script has been created:

Agreed, but should this be a standard script prepared by ALMA for any user or should it be the user's script. I strongly incline for the first hypothesis if it is a standard calibration or mode we are dealing with.

Reply: Agreed.

Comment 274 by MHoldaway

p 65
Basic course 3: "data *are* gridded"

Reply: OK

Comment 275 by MOhishi

p 65
Reduce Multi Field:
In Basic Course, Item 2, sub item 1. What is the "auto-epactra" ?

Reply: autocorrelation spectra...

Comment 276 by MHoldaway

```
p 66
  Notes 1: remove Notes 1, which is true

  Notes 2: haven't seen anything the details on-line displays.
```

Reply: remove Note 1; if time allows, write Quick Look Pipeline UC.

Comment 277 by MHoldaway

```
p 67

  Basic Course 13.2 This was boiler plate in other Use Cases as well...  beam information: this will
  be approximate, especially for highly stretched arrays or far N[S] observing: the snapshot beam
  and the full integration beam can be quite different.
```

Reply: Yes, so may be just an indication of resolution, in each limit ?

Comment 278 by MOhishi

```
p 67
Setup OTF Mosaic:
  In Basic Course, Item 13, sub item 4.  Don't we need to provide the
  dump time parameter ?
```

Reply: That should be guessed by the Tool (depends on maximum baseline).

Comment 279 by MHoldaway

```
p 68
  Notes 2.an additional: "beginning *of* the integration"
```

Reply: OK

Comment 280 by MHoldaway

```
p 69
  Postconditions Either write one or delete "1. ..."
```

Reply: We'll do the easy way, I guess ...

Comment 281 by MHoldaway

```
p 70
  Amplitude Cal:

  This applies to the other Use Cases: A 10 deg phase error is comparable in effect to a 17\% amp
  error.  Noise that results in 10 deg phase will result in 17\% amp errors.  The atmosphere usually
  makes the phase a lot worse than 10 deg, and the amp errors a lot less than 17\%.  So, in what
  conditions will we need amplitude calibration which is much better than the phase calibration?  We
  don't want to add extra noise to the map, so I guess we would average the amplitude solutions so
  that we are still dominated by the phase errors.  So, we aren't actually tracking the amplitude
  errors the way we track the phase errors.  But the amplitude errors aren't limited in time scale
  the way the phase errors are (ie, phase errors make a baseline-length filter of the atmosphere;
  the amplitude errors do not -- so there ARE really long term amp trends, unlike the phase errors).

  What does it all mean?  I don't know, I just stated what I do understand.
```

Reply: (You're pessimistic on the quality of WVR corrected atmosphere). Be careful however because amplitude errors can be much more systematic than phase errors (e.g. using a too weak amplitude calibrator, or having decorrelation on long baselines while using antenna-based amplitude calibration ...).

Comment 282 by MOhishi

```
p 71
Setup AutoCorrelator OTF-Map:

  In Basic Course, Item 4.  It would be better for the users to be able to specify frequency
  bandwidths and resolutions.
```

Reply: They should be able to do that too.

Comment 283 by NEvans

p. 71

ACOTF I guess this is what I would call total power OTF.

Reply: Yes: may be that's a more easy name.

Comment 284 by RTilanus

p. 71

UC 3.7.4:

took me a while to digest the first paragraph. What is meant is that 'in contrast to interferometric On-The-Fly maps in this mode emission-free OFF areas must be observed for part of the time'. Okay, nit-picking, but the way I read it initially was as if 'it is needed' was referring to 'Autocorrelation OTF-Maps'.

Reply: We'll try to reword this intro.

Comment 285 by MHoldaway

p 72
Issues:

"It is unclear frequency switching will be implemented...." However, there is a use case for Frequency Switching Mapping.

Reply: Yes; we should take that out. Apparently FS is there.

Comment 286 by NEvans

p. 72
Lots of unresolved issues.

Reply: Sorry for that, but it's better to mention them until they are resolved.

Comment 287 by MHoldaway

p 73
All Observing 1:

This reminds me: at one point, we were talking about reading the Modes pointing errors off of the encoders or from tracking information from the infrared telescope (assumed to be due to wind) and applying those corrections in the real time system. This would be applied in SingleField, MultiField, OTF, etc. Is the SSR doc the appropriate place to mention that, or is it hidden in the real time control software or the antenna requirements? At the very least, the user needs to be able to turn this real time correction on and off.

All Observing 2:

I've read assumptions like: SD is 15-30 minutes; and all sources Modes in a SB must be within 5 deg of each other. This is restricting the ALMA needlessly. I have used both the 12m and the VLA to do surveys in which we observe many widely dispersed sources each for about 60 seconds. Unless there are many thousands of these sources on the sky, equally interesting, we will end up observing for a few minutes in this 10 deg patch, and a few minutes in neighboring 10 degree patch, and then maybe a few minutes near the celestial pole tens of deg away. We should not design such capability out of the ALMA, as it will be more powerful than either the VLA or the 12m.

All Observing 3:

Where is the reduction script generated? Presumably in Modes SetupSingleField or SetupThisKindOfMapping. No mention. Where is the reduction script used? Presumably in ReduceSingleFiled or ReduceThisKindOfMapping. No mention.

There are no Use Cases for ReducePositionSwitchedTotalPower or ReduceFrequencySwitchedMapping

Reply: Point 1: read from the encoders and apply: I'm not sure I understand what you mean here: correct the amplitudes in real time ?

Using the IR? that looks like offset guiding in the optical telescopes; but it assumes the surface deformations and subreflector motions are negligeable.

If any of those apply it should be used much closer to the hardware. It would be a general technical option, not available to the observer.

Point 2: That's a good point. I think the 15-30 min is only a guide for SB length, there is no reason not to have shorter SBs (a few min.), as the SBs can share preambles. If you have many sources in the sky, it makes sense to group them for scheduling, as they may share calibrators, ... Then I don't see what is actually designed out ?

Point 3: We'll mention the reduction script. But it's more easy to do a data driven reduction script, so may be we'll use a standard one for each of these standard modes.

Comment 288 by MOhishi

```
p 73
Observe AutoCorrelator OTF-Map:

  In Basic Course, Item 1.  If this is the beginning ... . -> the Item 2, sub item 4.  We need to
  perform the focus scan after the pointing calibration scan.
```

Reply: OK We will specify that.

Comment 289 by MOhishi

```
p 76
Setup Position Switched Mapping:

  In Basic Course, Item 5.  It would be better for the users to be able to specify frequency
  bandwidths and resolutions.
```

Reply: As above. Yes it should be possible.

Comment 290 by NEvans

```
p. 76-79

There is an assumption that you will use beam-switching for continuum, but I see no reason for this
  to be true. I think a lot of continuum will need OTF or position switch.
```

Reply: This is an open question. I'm not sure you can get down to thermal sensitivity unless conditions are very good.

Comment 291 by NEvans

```
p. 77

  First mention of ACA; Issues 5 Yes, funny shapes should be allowed.
```

Reply: Well... reasonably funny!

Comment 292 by MOhishi

```
p 80 Setup Frequency Switched Mapping:

  In Basic Course, Item 3.  This should be done for each IF band to be used.  Item 5.  It would be
  better for the users to be able to specify frequency bandwidths and resolutions.
```

Reply: Probably.

Comment 293 by NEvans

```
p. 80  FS mapping

  Does anyone do FS. It never seems to work for mm/submm.
```

Reply: Should we drop it altogether ? What is ASAC advice ?

Comment 294 by JSchwarz

p. 82, Perform Frequency Switched Mapping (Total Power)

Basic Course 2.4, 2.5.1: references to "signal" and "reference" frequencies on the one hand, and "observing" frequency on the other. Probably 2.4 should be moved to replace 2.5.1.

Reply: Yes. I'm puzzled. It looks like 2.5.1 can be deleted. Jeff ?

Comment 295 by MOhishi

p 82
Perform Frequency Switched Mapping (Total Power):

In Basic Course, Item 2, sub item 5. Do we need to record the "signal" and "reference" scans separately, or to record only the "difference" spectra ?

Reply: That's what is usually done.

Comment 296 by MHoldaway

p 83 Basic Course

For the highest freqs, predetermined gain curves for each antenna will need to be used.

Is the procedure the same for interferometric and total power observations?

This Use Case seems a little vague.

Also, the only other use case which mentions this use case is ObserveAutoCorrelation-OTF Map, in spite of the statement here that this use case is executed in all scheduling blocks.

Reply: Why Gain Curves ? Here one would use TA* which does not depend on antenna gain (only on forward efficiency...)

I think it should be the same.

That's true but the actual calibration hardware is still TBD, as far as I know ...

Yes they should all mention it.

Comment 297 by NEvans

p. 83

Note suggests formula for choosing calibrator. This should be propagated through the document, but may need weighting of factors.

Reply: (in page 85 I guess). That's where the formula should be.

Comment 298 by MHoldaway

p 84 Precondi 2:

"or a list *of* nearby target sources, *has* been specified.

Basic Course 1: Why do they need to be in per cent and degrees?

Reply: OK; They need to have a clear unit, that's what we propose.

Comment 299 by MOhishi

p 84
Setup Gain Cal: In Basic Course, Item 2.

What is the frequency-dependent default policy ? Item 4, line 4. fluxes in the last few months ... -> in the last a few months .... In Notes, Item 2. an expert-only -> expert-only

Reply: We have not yet defined all policies ... and need not now.

Comment 300 by MHoldaway

```
p 85
  Notes:choice: 1) Minimize( the whole equation )

  This is Mel Wright's formula, derived from the assumption that there is no discernable thin
  turbulent layer.  OVRO's experience is often contrary, as is Yasmin Robson's at the ALMA site.

  I would restate my equation, minimizing ( vel_turb * t_cycle + d ), where vel_turb and d are
    vectors.  (d is the distance between the lines of sight at the height of the turbulent layer)

  So, we probably need a few choices here.
```

Reply: Yes but think of your other comment: this should be hidden from the user ...

Comment 301 by MHoldaway

```
p 86 Basic Course, 2.2

  Under some atm. conditions and some parts of the sky, there may be no suitable calibrator.
```

Reply: What do we do then ?

Comment 302 by DGRoh

```
p.88 UC: ReduceGainCal


  Gain variations at common mm-wave interferometer are smooth in time, but hard to predict the next
  gain value from previous measurements; while the cycle time could not be shorten enough.
  Therefore I think it is better that the UC ReduceGainCal might be postponed until the next
  measurement of calibrator. Then UC ReduceGainCal can use interpolated value rather than the
  extrapolated value.  This postpone cause a delay in data pipeline as long as "cycle time".
```

Reply: We have not been explicit enough. This UC only determines the calibration curve, and does not apply it. This means we can apply the calibration to show the data only after a calibration cycle. Note that the gain variations are not so smooth if the atmospheric phase is included !

Comment 303 by MHoldaway

```
p 88
  Issues 2: *parameterization*

   My suggestion for phase structure function parameterization:

   From spatial information (ie, many baselines) fit to

   delay = a1 * (b/b0) ^ alpha1/2  for b < bc
   delay = a2 * (b/b0) ^ alpha2/2  for b > bc

   b0 is arbitrary.  fit for bc, a1, alpha1, a2, alpha2

   Usually, adding bc, a2, alpha2 will not be warranted.

   If you have temporal phase data only (ie, phase time series on one baseline), then you can only
   get the structure function exponent and amplitude, but only for times less than b/v.
```

Reply: Do you think that baseline orientation (relative to wind) matters ? Actually those kind of formulae will be needed at a latter stage, when the actual observing modes are detailed. At this stage only the general software stucture need to be defined, so all we need to know is that there needs to be an algorithm of that kind.

Comment 304 by MOhishi

```
p 88 Reduce Gain Cal:

  In Basic Course, Item 5, sub item 3.  to evaluate a seiing -> a seeing In Issues to be Determined
  or Resolved.  Don't we weed to archive the gain calibration data to understand the time-variations
  of the receivers ?
```

Reply: It will be archived anyway; but note that receivers are not involved here; it's only the antenna gain (and residual atmosphere) if we trust the temperature scale calibration...

Comment 305 by JSchwarz

```
p. 90, Observe Interferometric AstroBandpass Cal, Basic Course 2, 3:

  What is the difference between the "calibration frequency" and the "target frequency"? These two
  frequencies are not referred to in the corresponding "Setup" Use Case, which speaks of the
  "observing frequency. I would guess that all three are the same, so that Basic Course #3 should be
  eliminated, but I'm not sure. I assume that the "target source" referred to here is the "bandpass
  calibrator" of the Setup UC. Is that right?
```

Reply: They are in SetupGainCal BC2. We should refer to that one here. These two calibrations are mutually dependent.

No the target source is the one to be observed, not a calibrator ...

Comment 306 by MOhishi

```
p 90 Observe Interferometric AstroBandpass Cal:

  In Postconditions.  I believe that the data will be archived.
```

Reply: I hope so ! All data should be.

Comment 307 by MHoldaway

```
p 93 Issues 1-2

  There are actually at least three sources of the delay, each with their own Use Cases (one is
  missing): 1) Physical Baselines, resulting in the geometrical delay 2) Difference in physical
  cable lengths and other system path differences 3) Differences in the atmospheric electrical path
  length

  (2) is the subject of this Use Case.  However, with a single measurement, we cannot distinguish
  any of these.  We can do a fit to the Baselines via several measurements.  However, if there is a
  residual delay due to baselines, observing a source delay calibrator far away from the target
  source will result in an error in delays back at the target source.

  Similarly, you also pick up the atmospheric delays at the position of the calibrator source, which
  will not be applicable at the position of the target source.
```

Reply: We do not speak here of (1) and (3), we aim at measuring (2) but (1) and (2) cause errors. I do not see any other solution than (1) accurate measurement of baselines and (2) compensate the atmosphere with WVR. Remeasuring the delays on a nearby source will not prevent a time varying delay due to the residual 'equatorial' baseline error.

Comment 308 by MOhishi

```
p 93 Setup Delay Cal:

  In the headings, para 3.  The observing actions to perform -> perform ?  In Basic course.  Why not
  show recommended values to the users ?
```

Reply: [I think you meant 'preform -¿ perform' which was my typo ...]
Note: the users here are staff astronomers and operators.

Comment 309 by MHoldaway

```
p 94 Preconditions 2 produce *small*
```

Reply: OK

Comment 310 by MHoldaway

```
p 96 Preconditions 1

  "..is available.  I am assuming" or better "...is available.  It is assumed that..."
```

Reply: OK

Comment 311 by MHoldaway

p 96 Basic Secondary:

I think if its a source of known polarization, there is no arbitrary phase (ie, its KNOWN). Maybe your meaning is the same as my understanding, and the text is just unclear to me.

Reply:

Comment 312 by MHoldaway

p 96-102 Pol Cal

The nature of this section is quite different from the other sections. I think this is because a) the goals and nature of the Use Cases have not been completely conveyed to all who are writing them, and b) the author has several important points to raise and nowhere to put them but here.

This material should go into the Calibration Plan. Now, it seems there are two competing documents (neither of them is very far along) which purport to be Calibration Plans: the Calibration chapter in the ALMA Project Book, which I am currently writing (the old version is VERY OLD, out of date, and incomplete), and I think a post-processing document which the SSR group announced it would be working on. These two efforts should somehow join forces or one should efficiently slay the other.

so the question at hand is: should we change this chapter to try to make this SSR document more uniform in scope? The easy answer is "no".

Reply: You're right. When the Cal Plan is complete and agreed on, we'll get a skinny UC like the others.

Comment 313 by NEvans

p. 96-98

A lot of questions about polarization calibration. Note that the Use case for observing polarization is not obvious here.

Reply: OK

Comment 314 by MHoldaway

p 97 General So, this has been gnawing at me for a while. There are many calibrations which you can pretty much solve for and apply iteratively (ie, as the data is coming in). However, interpolation in time may get a bit better if you have the future calibration data in hand for data taken NOW.

The polarization calibration is a better example, though: you often need all the data in hand before you can solve for the parameters and apply them. But some of the courses don't require the wait (ie, basic course 2 and 3).

There probably needs to be some KEYWORD that distinguishes the desired intention: LOCAL_CAL or GLOBAL_CAL. Well, this is too implementation-like, but you get the picture. It makes no sense to get a quick-look of polarization data that can't be calibrated until all the data is in hand. And IF it is a GLOBAL_CAL, there also need to be some sort of specification about the global needs (in this case, parallactic angle coverage), and the scheduler needs to account for those needs when it takes the program off and on the air.

Reply: Should this not be very much simplified with a coherent photonic source in the subrefs ?

Comment 315 by MHoldaway

p 97
Issues 6 "There must be"

Reply: OK

Comment 316 by MHoldaway

p 98 & p 100
Many of the comments are duplicated, making reading tedious

Reply: Yes, they should be grouped in one place.

Comment 317 by MOhishi

p 99 Observe Full Polarization:

In Postconditions. I believe the images produced by the pipeline are sent to the Science Archive??

Reply: Yes

Comment 318 by MHoldaway

p 100

Notes("I am")

This is a general issue: there are several overlapping or simultaneous use cases (ie, Gain Calibration + Polarization + XX :: XX = Multi Field or OTF Mosaic or Single).

It seems that it would be VERY WORTHWHILE to develop an object oriented framework which reflected or understood the overlapping or simultaneous structure of these use cases (ie, not all the Use Cases presented in this doc are on equal footing, and we need to explain how they are related).

See also the general comments I made concerning pages 60-62.

It could be argued that making such a structure would be a waster of time because Use Cases are not objects, and admittedly I don't understand the 'Unified Process' method of software design (ie, I get lost in the meta-meta-languages of self-writing jibberish), so I could be just plain off the mark; however, it seems to me that any coherent organization we come up with which better reflects the structure of what we really want to do is worth while.

Perhaps this is being addressed in the next stage of analysis which is underway.

Reply: Structuring these is the next step I guess. Before we interate on the contents may be.

Comment 319 by NEvans

p. 100

Myers raises question of whether to have separate ones for pol. I would say yes to keep the others simple.

Reply: OK

Comment 320 by JSchwarz

p. 103, SetupPointingCalibration, Introduction,

How do the "four pointing modes" correspond to the mode of the observer's science programme? Are the pointing calibration mode and the observing mode specified independently?

Reply: They do not. Nearly all pointing measurements are made in interferometric mode. The others are mainly used for special "I can't find fringes" cases.

Comment 321 by MOhishi

p 103 Setup Pointing Calibration:

In Basic Course, Item 4, sub item 5. The desired accuracy might not be achieved under the poor weather condition. We need to specify, for example, maximum number of iterations.

Reply: Yes

Comment 322 by RTilanus

p. 103

UC 3.8.7: I take it that 'auto-correlation' mode is what sometimes is called 'spectral-line pointing' in contrast with 'total-power pointing'. I fail to understand why 'total power mode' pointing needs a nutator: position-switching the telescope should also work I believe.

Reply: Well, the atmospheric emission fluctuates really too fast for position switching. May be OTF fast scanning will be enough.

Comment 323 by MHoldaway

p 104 notes

I would add another note here. Normally, the system noise will limit the accuracy of the pointing determination. However, in times of very poor phase stability, refractive pointing errors will dominate the errors. Except during episodes of "anomalous" refraction when a large coherent structure (with little fine structure) of water vapor crosses the antennas, the refractive pointing will have time scales comparable to the crossing time of the antenna, or about 1s. Hence, the best way to deal with these errors is to average for a long time, either be doing each of the half power points for longer, or by coming back to them several times. Intuitively, I am guessing that the circular pattern, spun several times around, may be the best thing for this. Still, more time must be spent on the pointing cal than when refractive pointing is stable.

So, we probably need to have some sort of feedback, either from the phase-o-meter (site testing interferometer) or from the phase cal solutions, to the pointing calibration to inform it what the best pointing cal strategy is at this moment.

Also: I would suggest that my comment inspired by p 73 (above; concerning measuring pointing errors via encoders or an optical telescope and applying in real time) be thought about at this point. Does it belong here?

Reply: I agree with you for the circular pattern; that's quite attractive for this reason. But for the strategy the residuals from the sinewave fittings in the circular pattern mode should tell you right away whether you are limited by thermal noise or by phase fluctuations (I had found such a correlation at PdB: see my memo a few years back).

Comment 324 by MHoldaway

p 105 Basic Course 3:

Just an idea, I haven't worked through the numbers to determine if its possible (ie, it might be that when this is an issue, the refractive pointing is too bad anyway). So, you will have phase errors on each of the half-power pointings, which could lead to decorrelation and hence lower amplitudes and an error in the pointing determination. However, you can do phase self-cal on each of the half-power points to eliminate that problem. Any source strong enough to be a pointer is stronger enough to be a phase calibrator.

Reply: I'm not sure your self cal can be fast enough (at sub second integration times) to correct for decorrelation. The WVR is better I think.

Note also that we should not have pointing sources with internal 183GHz H2O emission: WVR may have some troubles.

Comment 325 by MHoldaway

p 105
Basic Course 6:

In addition to archiving the pointing results, they should also be stored in a table with the astronomical data, as there will be algorithms which can utilize this information in image reconstruction. ie, immediately AFTER a pointing cal, we can assume the pointing errors are, on average at least, zero. And we know about what they were immediately before the pointing cal. Hence, we can interpolate back through time to immediately after the previous pointing cal (also zero errors). Algorithms to reconstruct images with known pointing errors are non-trivial, but implementable.

Certainly a trivial use for the antenna pointing solutions as appended to the astronomical data would be to flag antennas which had pointing which went bad. This can be done both on-line (for disastrously bad antennas) and off-line (ie, if someone making a very high dynamic range image discerns that some level of pointing error is too much).

Reply: Obviously it is easy enough to implement an *a posteriori* correction for the single-dish mapping. Mosaics are more difficult.

We could use this for scheduling too.

Comment 326 by MHoldaway

```
p 108
  Preconditions

  As the baselines are generally determined right after antennas have been moved, I would add the
  precondition that the array pointing calibration has been performed already.
```

Reply: Yes; or shown to be unneeded.

Comment 327 by NEvans

```
p. 108 baseline cal

  GPS is an interesting idea. Issues raised by continuous reconfig. are important. Does one run the
  pipeline again after the other antennas have their baselines determined?
```

Reply: Either: Yes or rather: mark it to be needed so that the data is recalibrated when it needs to be accessed.

Comment 328 by RTilanus

```
p. 108

UC 3.9.1: personal interest: GPS is 3 times worse than astronomical?  If I remember correctly you
  need to get the baselines to within 5 \% of the wavelength which at 690 GHz corresponds to about
  450um. Can differential GPS can give an accuracy of ~70um?  Nevertheless, being able to get the
  initial conditions to within a wavelength (even at lower frequencies) will be extremely helpful.
```

Reply: At Bure we are within 1mm by mechanical repositioning, which is enough do do the baselines easily.

Comment 329 by MHoldaway

```
p 109
  Notes("The data") At the VLA, the number of sources approaches 100.
```

Reply: OK

Comment 330 by TOhnishi

```
Page112 Basic Course 2

  "(time, temperatures)"; wind may affect the pointing the most strongly.
```

Reply: Yes but it will not be easy to use it to improve the fit. It's really an error term. As the atm phase fluctuations.

Comment 331 by GHarris

```
P 113 Appendix A Observing Objects = This section needs an introduction stating that the following
  objects have a hierarchical or container structure.
```

Reply: Yes; though this not sure for OB Groups (not there anyway).

Comment 332 by LTesti

```
p.113
Proposal.

      A simplified instrument setup should also be attached to the proposal. This should include the
      following sections:

      - Array [configurations/number of antennas/resolution/short spacings]

      - Receivers (or freq. bands, as already specified)
```

```
    - Correlator setup
```

Reply: Array: only resolution/short spacings.

Comment 333 by LTesti

```
p.113

Project.  A scheduling committee may also be needed (to check for LST crowding national shares, if
  required, etc).
```

Reply: Maybe. That's an obvious science operations issue.

Comment 334 by LTesti

```
p.113

  I think that P2PP should be enforced for every program, I would not trust somebody deciding for me
  what to do without my feedback, so the best thing to do is to drop on me all the workload and
  responsibility...
```

Reply: What me meant by it being optional, it that it would be so simple that it could be done right away with Phase I: Nobody would do it for you, you would have done it already.

Comment 335 by MHoldaway

```
p 113 Appendix A Observing Objects

  Proposal: It may be beneficial to have a technical categorization (as indicated here) and a
  scientific categorization (ie, as at the VLA, to aid reviewers).

  Technical Categories:  (spectral line/continuum)
     (single dish/array)
     (detection/imaging/high dynamic range imaging)
     (single field/mosaicing)
     (millimeter/submillimeter)
```

Reply: Yes; we had mentioned part of this in the UCs.

Comment 336 by NEvans

```
p. 113

  For clarity, this section should be moved earlier in document.
```

Reply: That's a good idea. We may insert it before the requirements, while the examples of SBs will stay in the Appendix.

Comment 337 by LTesti

```
p.114
Break points.

  I got confused by the false/true status: what does it mean that a breakpoint must be true before
  scheduling and false before scheduling is completed? (shouldn't it be false "after" it has been
  completed?  I missed something)
```

Reply: It's just a definition: At the breakpoint do we continue (true or false). But may be we are looking at it from opposite sides !

Comment 338 by LTesti

```
p.114
SBs.

      The maximum repeat count is very confusing, if the proposal allocation time is based on
```

sensitivity requirements. All current arrays are dynamically scheduled, the net result of this is that only the highest available frequency is scheduled in the best possible weather for that frequency (e.g. 3mm projects are always scheduled in poor weather conditions). On the other hand, for best publicity, all existing arrays quote on their sensitivity tables 3mm sensitivities in "typical" weather which is usually not as bad as the weather of "typical 3mm scheduling". ==> If one computes the maximum number of repeat for typical weather it will never reach his goal sensitivity.

For preamble/postamble one should also specify conditions for execution (e.g. do not execute if done within the past n-hours).

In the status, I would also add the total array time used so far

A source list MUST exist after P2PP (last point before examples).

Reply: The maximum repeat count is overlapping with the maximum total time allowed and the maximum time duration. We could keep only two of these.

Agreed on all other points.

Comment 339 by MHoldaway

p 114
SB: maximum seeing parameter required:

Note that for baselines over a few hundred meters, ALMA will often require phase intervention (ie, WVR or fast switching) to achieve the potential resolution. Furthermore, fast switching (and presumably WVR) will be effective in a manner which is independent of baseline length. So, the situation is more complicated than alluded to here. This text would be appropriate to an array with no phase intervention strategy.

Fast switching will chop off the phase structure function at some short equivalent calibration baseline. The calibration cycle time itself is also a parameter that is to be optimized, though we could make nominal ones for each frequency band, and say that the phase structure function evaluated at that cycle time (or its effective length) be less than some value for that frequency.

The permitted phase fluctuations (and the cycle time strategy) will also depend upon the technical categorization (ie, detection, imaging, high dynamic range imaging). In fact, I would argue for determining the default values from the technical categorization.

Reply: OK.

Comment 340 by MHoldaway

p 114
SB: I would add:

-- maximum pointing error (systematic and random components); (as inferred from wind, anomalous refraction estimates, solar-induced thermal gradients, or pointing drifts between pointing calibrations)

-- maximum surface errors/beam errors (as inferred from measured solar-induced thermal gradients)

Reply: Yes; Yes

Comment 341 by MHoldaway

p 114 SB:

You know, it would be really easy to ask for such wonderful conditions that they would actually never occur on the site, basically precluding scheduling. We need a check for this; ie, the observing tool would look at your SB, and come back and say "Based on historical site data, this program could be scheduled 12\% of the time during winter nights; as the ALMA will be in your desired configuration during summer days, there is a 0.0\% chance of scheduling"

Reply: Yes we should do that.

Comment 342 by LTesti

```
p.115
Examples.
      I would structure:
      for i=1 to n {
        calibrator
        source
      }
      calibrator

      Or, better, as OVRO:
        obsblock1{
          calibrator
          source
        }
        obsblock2{
          calibrator
        }
        execute obsblock1 if(LST>START && LST<STOP && REPEAR<MAXREP)
        execute obsblock2

      (and complex combinations of the above, including calibrations, pointings etc...)

      Dual bands: I think it is more efficient to do separate blocks for separate bands.

      Mosaicing, interferometry: you need calibrator here as well
```

Reply: OK

Comment 343 by MHoldaway

```
p 115 SB examples:

  If fast switching is used, you will let the system determine the optimum switching cycle for you
  technical categorization.  You won't specify "1 minute on target, 10 s on calibrator".  You would
  like to specify "20 minutes doing target while fast switching".
```

Reply: Yes: these were just simple examples to explain the SBs...

Comment 344 by MHoldaway

```
p 115
SB example:

  Mosaicing: I would put in a pointing scan at the end too (or at least as the start of the
  postamble) so that you could always monitor the change in pointing over every SB
```

Reply: ditto

Comment 345 by MHoldaway

```
p 115
SB Pre/post amble: Some observations may require pointing only in
  the pre/post amble (ie, 30 GHz).

  Sometimes things like polarization/bandpass calibration would not
  really fit into a postamble: you might need to observe the
  particular calibration source in the middle of the observations
  while it is up.
```

Reply: It's always more complicated with polarization ...

Comment 346 by GRaffi

p.116

Observation This is a component where consistency checks should also be done by the OT tools.

Reply: Yes. That's the lowest level for such consistency checks.

Comment 347 by LTesti

p.116
Observing session.

As discussed above the scheduler should optimize scheduling also to reduce calibration time (preamble/postamble calibration) which in some cases may be substantial.

Reply: Yes that was agreed above.

Comment 348 by MHoldaway

p 116

first paragraph "mainly exceeding a minimum flux" should be replaced with "mainly, a combination of calibrator strength and proximity to the target source"

Reply: Yes; this was just an example.

Comment 349 by MHoldaway

p 117

This rule doesn't apply to witching cycles for fast switching phase calibration, that switching is super-Integration.

Appendix B Observation Descriptor

hmmmm..... this is pretty detailed.....

no comments at this time, though this is exactly the kind of thing which deserves careful comments. Maybe later?

Appendix C Glossary

Reply: Yes this was only indicative, and should be commented by many people.

Comment 350 by LTesti

p.118
Appendix B.

> There is a lot of redundancy in these headers. Probably a hierarchical system should be used. e.g. the project ID is likely to be the same for the entire SB, there is no need to save in the database this thing for every observation descriptor (etc. etc.). In case you may be willing to extract a single observation from the database, the various parameters can be easily extracted from the hierarchy (without the need to be saved millions of times for the same SB).

Reply: It was not intended as a header but as the minimum amount of information that the hardware must be given to perform an atomic observation. I agree it is still redundant in this sense.

Comment 351 by GHarris

P121
C Glossary and Acronyms = This section needs some clarification and addition:

AOS - MISSING - The control and command section of the ALMA instrument. It is responsible for executing observing commands on the hardware.

Alarm - better definition - Alarms are logged errors with sufficient severity to alert the operator.

Command - "expression" is a bad choice of terms from a computing language technology perspective - better definition = A command is a statement executed by the ALMA instrument causing some discrete action in the equipment. It comes from the repertoire of the ALMA command language grammar.

Engineer - append "and software."

Mode - better definition = A state in which operations are constrained to a particular set of procedures for specific goals - e.g.: Interferometry or Total Power

Process - bad definition limited to one kind of computer - better definition = A program in execution. It consists of a dynamic image executable on a particular computer which changes over time from the original program. It may also access resources external to the program such as files and change their state over time.

Reply: OK we'll improve those definitions.

Comment 352 by MHoldaway

p 121 delay tracking center uncapitalize "Conversion"

Reply: OK

Comment 353 by MHoldaway

p 122 pattern: "?strokes?" (my version has question marks where they don't belong.

Reply: OK

Comment 354 by MHoldaway

p 123 subarray: "More explanation is needed here". And now is the time to do it.

Reply: OK

Comment 355 by MHoldaway

p 123
target: "antenna?s" apostrophe as "?"

Reply: OK

Comment 356 by MHoldaway

p 123 Unified Model: It would be nice to define something about the Unified Model approach to software engineering.

Reply: OK, I'll get that from the software engineers ...

Comment 357 by DWilner

The SSR document presents an impressive plan. Clearly a lot of work has gone into elaborating the use cases and defining priorities. I don't think it is particularly useful at this point for me to comment on individual use cases-- the notes and unresolved issues are already extensive. Instead, I have just general comments on implementation. I will consider more carefully the details of use cases before the telecon.

- The success of the software will depend on the ability to bring up quickly a compact and nimble package to take care of essential operations. Practical implementation of the abstract use cases will be the key. Without doubt, there will be points of fine adjustment within the current list, and also cases that no one can yet imagine. But the truly necessary parts to get ALMA going within this large document must be identified and given highest priority, as these parts have to be done first. At the same time, the software design needs to be able to handle ongoing development. It's great to see priority levels attached to the many functions under consideration at this stage, but there are already a lot of ''priority 0'' requirements. The software has to remain sufficiently modular that the more complex tasks do not hold up progress on simple tasks. For example, the OTF

mosaic interferometric observations should be an extremely effective and efficient observing mode, but this complicated mode that has never been tried before clearly cannot have the same priority as basic single field imaging observations. The document doesn't reflect this.

- The practical management of the dynamic queue and pipeline is still not entirely clear to me. This is necessarily wrapped up with other issues of scheduling and operations that are not resolved, like antenna reconfiguration strategies. Section 2.4 outlines a set of rules to guide scheduling decisions, but I suspect that reasonable people will disagree about these rules, and how to put them in practice. In any case, the bookkeeping of Observing Blocks will be complicated. My concern is that the software will be impacted by the nature of the rules that are ultimately adopted. My concerns are similar for the pipeline. Exactly how will the processing be done? Will there be entirely new implementations of standard algorithms? Or will these be extracted from existing packages? How much of the pipeline system needs to be in place before any of it will be useful? Again, it will need to be amenable to growth as the more of the hardware comes on line.

Reply: We have not prioritized the Observing Modes; If we list them in the requirements we may attempt to do so.

Comment 358 by ABridger

General

This is a very good looking document, the overall progress is impressive. It is also a big - and growing - document, which is a bit inevitable, but does make it difficult for individuals to find time to comment on all of it. This is one reason I have concentrated my comments in just a few specific areas, and I would suggest that this might a good way to review documents like this. Obviously some overall vision is still required though.

Reply: Agreed, on my side.

Comment 359 by ABridger

p. 1. sec. 1.

It has been pointed out elsewhere, and also becomes clear in some of the issues raised during the use-case descriptions, that there is not yet a well developed operational concept for ALMA. This will impact, perhaps strongly, on some of the requirements. Perhaps this should be mentioned in the Introduction, to raise the issue and as a place holder.

Reply: OK. I'll add a sentence to state that.

Comment 360 by ABridger

p. 13. sec 2.3.

There is no mention in this section of observer authentication and any security measures that may be required. I assume that observers will need to authenticate themselves to the phase 1 and phase 2 repositories, certainly to retrieve programmes, possibly to submit. And that they will only have access to certain programs. (Affects several use cases too).

Reply: OK

Comment 361 by ABridger

p. 13, req. 3.0-R3.

Do the phase 1 and phase 2 processes really need to use the same tool? I agree that this is an attractive approach but there may be practical reasons for not constraining the developer to put all of the required functionality into one tool. Certainly the solution must be compatible with the output of phase 1 becoming the input of phase 2, and a common look and feel should be required. An additional thought: if there is just one tool, should it also form the observer interface for querying the status of their programmes?

Reply: The User should be able to do both Phases I and II in a simple sequence, and submit his proposal including Phase II input. That's the reason for having a single tool, on the observer's side. There should be no need to re-identify, search for Phase I data, ... in that case. The tool components as specified in the Requirements should be available at both phases.

Comment 362 by ABridger

```
p. 13, req. 3.0-R5.

  At phase 1 I would have thought that the scheduling requirements of the program would be required,
  perhaps here, or perhaps under req. R6 or R7. I would have thought that the time allocation
  committee would need this information.
```

Reply: That's implicit in R6 but should be more explicitly stated.

Comment 363 by ABridger

```
p. 13, req. 3.0-R7. Does use of sub-arrays come here?
```

Reply: Probably yes; when only a sub-arrays is required it should appear here.

Comment 364 by ABridger

```
p. 14, req. 3.0-R15.

  This requirement sounds like it could be very complex. Perhaps some guidelines as to the sorts of
  things that are envisioned would help, otherwise it sounds like it might be expensive to
  implement.
```

Reply: Yes, several comments have been made here, we'll explain those rules.

Comment 365 by ABridger

```
p. 27, 3rd issue.

  One observing tool or not? See previous comment.
```

Reply: OK

Comment 366 by ABridger

```
p. 29, basic course, part 3 (and affects other parts).

  Perhaps using various "modes" to distinguish beginner/experienced/expert is really a solution, not
  a requirement. Other possible solutions exist, e.g. use of an "Detailed Options..." or "More..."
  button and use of a "Wizard". However, I certainly agree with the basic idea. Might need more
  thought and/or some prototyping.
```

Reply: Surely prototyping will help for this.

Comment 367 by ABridger

```
p.29, general comment.

  Use of "Libraries" of common observing setups could form part of - or be - the "beginners
  mode". If it is true that perhaps 90\% of observing will use such standard setups then that can be
  very effective. On UKIRT with the ORAC Observing Tool we have implemented several libraries and
  about 90-95\% of users simply use the library setups (infra-red observing is also very amenable to
  standard setups).
```

Reply: Libraries are what we call 'standard modes' or 'templates'.

Comment 368 by ABridger

```
p. 30., last "note".

  This will need to be tied down more - but obviously cannot be done yet.
```

Reply: OK

Comment 369 by ABridger

p. 35. first issue.

I agree that the process and the technology of the review process will need to be settled. I really feel that for a telescope that will come online in the second half of this decade we should try to drive a more electronic review process - but this obviously needs agreement with and changes by the relevant time allocation committees.

Reply: This is a very politic issue ...

Comment 370 by ABridger

p. 37, basic course item 4.

I presume "reconfigured" should be "preconfigured". These might be the "libraries" I refer to above?

Reply: Yes 'preconfigured'. Yes they are.

Comment 371 by ABridger

p. 37, basic course, item 5.

Again, does "array configuration" here include sub-array definition?

Reply: Yes, if needed. But we agreed that standard programmes should not have to specify a minimum number of antennas.

Comment 372 by ABridger

p. 40. Issue no. 1.

My opinion on this: If the observing "script" is a script written in a programming language (e.g. Python) then "validating" it might be very difficult to impossible - unless it is simply the standard ones generated by the information from the phase 2 tool, in which case why not simply validate the information? Validating a custom - or "free written" script is hard, whilst validating declarative information is relatively easy.

Reply: Agreed; but the "free written" scripts could be validated by using the simulator.

Comment 373 by ABridger

p. 44, in description.

In manual mode SBs etc. are sent directly from the observing tool to the AOS. This is an interesting alternative. I'm not keen on multiple points of entry - but this might be useful. If required then perhaps the OT and the scheduler share components.

Reply: The manual mode will only handle commands, and the interactive mode, only SBs. We'll rephrase this.

Comment 374 by ABridger

p. 45, third issue.

This is a very good question. Another alternative is to force interactive observers to go through the phase 2 tool. To some extent "experts" might object to going through any front end tool. However, how much truly interactive observing is ALMA going to do? If the answer to this is close to none then perhaps we stick with the phase 2 tool and/or scheduler. Of course there is engineering and the developement of observing scripts by staff astronomers - and these will certainly require more intimate access.

Reply: We have defined a policy on this: see previous comment.

Comment 375 by ABridger

```
General: Perhaps some definition of some of the actors in the use-cases might be useful. Some, in
particular the various repositories, are also part of the required solution, and perhaps should be
observing objects in appendix A.
```

Reply: May be.

Comment 376 by ABridger

```
General comment:

I worry about the output of "scripts" directly from the observing tool into the SB database. This
is one way to do this, but it has problems: modified scripts cannot reliably be read back into the
observing tool (which might be a desirable thing to do).  "Old" scripts generated by old versions
of the OT might still be valid in terms of the information that went into them (i.e. what the
observer wanted) but may be out of date if the template that was used to generate it has
changed. Another approach would be to generate the scripts nearer to the observing time - on the
fly or earlier in the day.  "Experts" could still have the option of writing their own scripts,
perhaps starting from templates, and with appropriate warnings about what they are doing. But they
are "experts" and can take responsibility.
```

Reply: I don't think the time at which the scripts are generated makes a difference: the versions of the OT and of the observing system must be kept compatible anyway. But the advantage of having the scripts generated by the OT is that they can be proposed as starting points for editing by experts (most of their changes are expect to be small anyway).