Input to the ASAC face-to-face meeting in CV

Momose, M. (Ibaraki U.)

1 About Charge 1.

1.1 Impact by Decrease in Antenna Number: ALMA + ACA imaging simulation

- I asked Tak. Tsutsumi (NAOJ) to quickly carry out imaging simulations in case that the number of the ALMA antennas is reduced.
- Basic simulation parameters are as follows:
  - + **Frequency:** 230GHz
  - + **Array Configurations:** ALMA c1; ACA sp6 (packing ratio =1.25)
  - + **Number of Pointings for mosaicing :** 19
  - + **Image Size:** $70'' \times 70''$
  - + **Duration of Observations:** ALMA: 18 min. total, or 1min. per pointing (H.A. =(−0.15− +0.15) hr); ACA: 72 min. total, or 4min. per pointing (H.A. = (−0.6 − +0.6) hr)
  - + **Used Image Models:** 4 (HCO^+ core, M51 HII region, Cluster, M31) for error-free case, 1 (HCO^+ core) for the cases in which errors are included.
  - + **Number of antennas of the ALMA:** (60/57/54/51/48/45) for error-free case and (60/54/48) when errors are included. Both cases of reducing the inner / outer antennas are examined.
- Primilimary results with GILDAS simulation package can be found at the below URL:

  `http://www.nro.nao.ac.jp/~imaging/ACA/L4/index.html`.

  Although the number of simulations is so limited that we have not yet obtained conclusive answers, the results can be summarized as follows:

  - In error-free cases, the impact of decrease in antenna number is more severe when the inner array antennas are removed. The case of removing the outer array antennas tends to give a better image fidelity than the case of removing the inner antennas when the number of antennas is the same. (The change of the synthesized beamsize is less than $0.2''$ so its effect would be negligible.)
  - In cases of error-free and removing the outer antennas, the fidelity gets considerably worse ($\sim 15\%$ at 10% threshold level) when the number of antennas is ≤ 54, while no significant degradation can be found when the number of antennas is ≥ 57.
  - In cases only a single error is included (3% error in amplitude, or $0.6''$ rms pointing error, or atmospheric phase error), a larger number of the antennas gives better results at lower levels ($3 - 10\%$ thresholds), though no difference can be found at higher levels. This tendency, however, disappears when all the errors are included. Since the number of simulations including errors is still limited (averaging three trials for each case), further studies are required to obtain more convincing conclusions.
  - There are several puzzling tendencies that can hardly be explained: for example, the results for (ALMA + SD) without error show that smaller number of antennas tends to give better fidelity. The results of HCO^+ core using all the array (ALMA + SD + ACA) with 45 ALMA antennas also exhibit higher fidelities than expected. Since the simulations are still preliminary, we should continue this study to get more convincing conclusions.

1.2 Receiver bands

- Dropping some receiver band will make the line emissions in this frequency range completely unaccessible. That will be a fatal scientific loss for the ALMA; the losses in sensitivity and imaging capability caused by the decrease in number of antennas can in principle be recovered by longer integration time unless the target object is very time-critical, but the loss in frequency capability cannot.

- If the number of available antennas will be cut in some receiver band, studies that required comparisons among different frequency bands (e.g., taking intensity ratio between different transitions) will be limited by the lower number of the available antennas. Such a reduction will not be an optimum way from the scientific point of view.

1.3 Compromise of Antenna Specs

- Compromise of antenna specifications (e.g., pointing, surface accuracy, etc.) should be avoided because it will significantly depress the capabillity at submillimeter wavelengths (in Bands 9 & 10). Since the performance of the antennas will virtually be fixed once they have been constructed, their specs should not be compromised.

2 About Charge 2

- ALMA is an international collaboration based on an agreement that the observing time will be shared proportionally to the contribution ("value") of each partner. In such a framework, regional PRCs may be a good way to clarify the responsibility of each community to maximize their scientific outputs. The scheme of regional PRCs will also be an effective way to develop different flavors of each community or scientific varieties, cultivating rich possibilities of the ALMA. This point will be extremely important at least for several years after the scientific operation is started.

- Instructive example to handle this kind of international collaboration can be found in the case of the X-ray satellite ASTRO-E2, a collaboration of Japan and the US and will be launched in the next February. Their rules to allocate the observing time is as follows;

  - The observing time will be divided into three categories: (i) the time for the core science working group which consists of $\sim$ 70 Japanese and $\sim$ 40 US scientists who are deeply involved in the project and 5 advisors from ESA, (ii) the Japanese time, and (iii) the US time.
  - All the observing time in the initial half year after the launch will be allocated to the core science working group, but after that, the time will be shared so that (i) : (ii) : (iii) to be 25% : 37.5% : 32.5% (the remaining 5% will be used as the "JP-US common time", see below) .
  - Call for proposals as well as their review processes will be made individually for the Japanese and US times.
  - After the decisions of the PRCs, all the accepted proposals will be checked whether there are duplicated proposals. If the two proposals request exactly the same object, only one of them is accepted according to the following criteria.
    1. the proposal with better rating will be picked up.
    2. the proposal that requests longer observing time is picked up if the ratings are almost the same.

3. the decision will be made through negotiation between Japan and the US if there are no significant differences in scientific rating and requested time. If both the proposers agree to share the data, these two proposals are merged and carried out in the "JP-US common time".

The intention behind the second rule is that an accepted proposal with longer requesting time should be more important. This may be, however, debatable especially in a case of ground-based facility like the ALMA.

- My impression is that the similar rules can also be applied to the ALMA case. International PRC should be necessary to coordinate the duplications and to accommodate the priority lists, but the main reviewing processes can be a matter of PRCs in each community.