Response to PAB2016 comments

PAB Comments

iKAGRA Run

Recommendation 1: The PAB strongly recommends that, in working towards the March 2018 bKAGRA operation milestone, the team should plan on implementing the simplest system possible to achieve the milestone, minimizing discretionary effort and expense. Deferred elements of the system may be implemented after that milestone, informed by lessons learned during the initial bKAGRA run.

→OK (See next page)

Response

- Based on the bottom-up schedules from subsystems, and according to the comments from the PAB committees, we discussed the simplest target and milestones for March 2018 bKAGRA phase-1; Cyrogenic Michelson configuration.
- 2/12-2/16 (2018): lock Michelson (Y=cryogenic, X=room temp)
- 3/2- (2018): start cooling of ETMX, and start “test run with keeping MI lock condition during cool-down”

Management

Project Management

Recommendation 2: A full-time on-site person, or equivalent, must be added to the KAGRA project team to better support the on-site Project Manager well before the bKAGRA phase of activity ramps up.

→OK

System Engineering

Recommendation 3: Proper system engineering practices must be implemented for the bKAGRA phase of KAGRA. The PAB has recommended above that the simplest version of bKAGRA be targeted for the initial bKAGRA run to assure success in this important step. System engineering should properly accompany this initial bKAGRA installation and will provide an essential technical base for the orderly improvement and exploitation of the full bKAGRA capabilities.

→OK (See next page)

Response

- From the experience of iKAGRA installation, full hanging test of the cryogenic payload to the Type-A VIS bottom (scheduled during Jun to Aug 2017) is important for fit check and installation training, in advance. SEO provides a dummy sapphire mirror for this full hanging test.
- Making a Gantt chart based on the bottom-upped schedules from the sub-systems, SEO inserts contingency time.
- Also, schedule-tracking scheme is discussed and established after the single Gantt chart in MS Project file till Mar 2018 was made. While we continue to have weekly meeting for on-site working, each chief updates his chart by Wednesday of the week before each chief meeting. The scheduler of SEO checks delayed tasks and ask the chiefs for more explanation. If necessary, PM will put the issue on the agenda of the following chief meeting.
- SEO has made a budget list of estimated/available/spent, so that the procurement required for simple configuration of bKAGRA phase-I is to be spent first. SEO is frequently (once a month, or so) checking execution amount. It is helpful to know a work-progress of each sub-system.
- Although SEO tried to cover shortage of man-power by “call for shift” in iKAGRA, it was insufficient. SEO will spend some amount of Operation Budget to outsource such works as cleaning.

Safety

Recommendation 4: Repeating our prior recommendation, KAGRA should go forward with an imminent comprehensive safety review. With gravitational waves now detected, KAGRA represents a long term Japanese and global science asset with a long career ahead. Safety must be approached as an essential existential element of the KAGRA project. The safety review charge should be very thorough. The panel should include outside experts in all aspects of safety including underground and mining safety. The panel should include international experts in safety from other underground science facilities such as the Sanford Laboratory in the US, Soudan Laboratory in the US, CERN in Switzerland, the Gran Sasso Laboratory in Italy and the Sudbury Neutrino Observatory in Canada as KAGRA is dealing with highly specialized aspects of safety in underground science. Reviewers selected solely from within the University of Tokyo community, or the Kamioka community may well be important participants but they should not be considered as sufficient. Fifty years from now, KAGRA should be remembered for its great scientific advances. It should not be remembered for a terrible accident in a confined space in the x-arm. That is the perspective that the safety review panel, and the KAGRA team, should assess.

→OK (Safety Review on Mar. 22-23)

Safety

Recommendation 5: In the interim, before properly addressing the safety issues described above, current provisions of supplies, especially breathing gas, must be substantially increased in the shelter area. The danger from toxic fumes produced in any fire in a confined space must not be appreciated by KAGRA team members. Adequate breathing gas supplies and systems and training in their use are a prerequisite for any further use of the unsafe x-arm spaces

→OK

Recommendation 6: A robust means of communication to the surface (both in the event of accident and of power failure) must be provided in all areas of the tunnel, but particularly for the shelter area at the X end station.

→ **Not yet**

Recommendation 7: Safety drills must be conducted regularly and safety tests of systems in place should be practiced regularly.

→OK (Safety drill on Nov. 8, 2016)

Safety

Recommendation 8: All installations should start in the safer y-arm as per our prior advice. This assures that activities in the x-arm are carried out after the y-arm learning curve has been experienced.

→OK

Firstly, installation of Type-A VIS and Cryogenic payload at Y-end is to be done.

> 12/20 - 3/31 (2017): installing Type-A VIS at Y-end

> 4/1 - 6/30 (2017): installing Type-A VIS at X-end

> 6/1- 8/31 (2017): full hanging test at Y-end

> 9/1-10/31 (2017): installing ETMY (original sapphire mirror)

> 12/8-: start cooling of ETMY

> 1/8-2/2 (2018): ETMX installation

> 3/1 - (2018): start cooling of ETMX

Safety

Recommendation 9: There should be a safety presentation at every PAB meeting.

Technical

bKAGRA plan and schedule

Recommendation 10: As soon as the boundary conditions for the goals of Phase 1 (Ando's talk) have been set, then each subsystem MUST submit a detailed plan. This plan should substantively incorporate the lessons learned from iKAGRA. Every subsystem should come up with clear milestones that define the pace of the program. Resource conflicts, tasks sharing, influence on other subsystems, should then be clarified by SEO. If needed then KAGRA management should decide on the way forward. Recommendation 11: bKAGRA planning must include sufficient schedule and manpower contingency to avoid the emergency descopes and deferrals experienced in iKAGRA. Simpification of the goals for Phase 1 bKAGRA is essential for a robust plan.

Recommendation 12: The phase 1 plan should try to accelerate testing of subsections of the interferometer wherever possible, instead of concentrating on installation followed by a burst of commissioning after everything is installed.

- *Plan-alpha could be very beneficial in that it decouples the Type-A VIS from being in line with the main program.*

→OK (in commissioning talk)

Technical

Recommendation 13: The Intermediate 300 K option sounds attractive, but it goes against the notion of concentrating resources on the required phase 1 bKAGRA deliverable.

Unless significant NEW manpower can be found, the PAB recommends against it.

→OK

Recommendation 14: For bKAGRA installation and commissioning, the PAB recommends that use should be made of contracted technical and housekeeping effort to support KAGRA team members in installation and in cleaning in the tunnel environment. Significant assistance to the VIS and CRY teams should be provided by adding contracted effort.

→OK

Technical

Cryogenics

Recommendation 15: The Cryogenics team should consider options to accelerate the Y ETM installation at KAGRA, both to reduce risk for their systems and to allow other systems to be commissioned early.

Mirror Subsystem →OK

Recommendation 16: KAGRA should investigate whether there are any affordable steps that can be taken now (such as rough polishing one or more substrates) to reduce the delay that would be caused by an optic being damaged during installation.

Digital System →OK

Recommendation 17: Ensuring accurate time synchronization for all DAQ units is important and a task that should not be put off until bKAGRA commissioning starts.

→OK