

Scientific and Technical Advisory Panel (STAP) Report 'Imaging and Engineering'

March 21st, 2019

Video Conference

Panel Members:

Sven Vogel (Chair), LANSCE

Winfried Kockelmann, ISIS (not attending)

Javier Santisteban, Centro Atomico Bariloche (not attending)

Francesco Grazzi, CNR

Luise Theil Kuhn, DTU

Stephen Hall, Lund University

Nikolay Kardjilov, HZB

Date of report:

23 March 2019

Participants

The meeting was held by video conference with five STAP member (Grazzi, Hall, Kardjilov, Kuhn, Vogel) and representatives of ESS, HZB, HZG, NPI, TUM, and PSI present by video conference.

Executive Summary

We wish to thank Premysl Beran organizing the meeting.

The ESS update by Ken Andersen included start of construction in E01, the statement that the project planning does not include any slack towards the early commissioning, as well as the ESS definition of early science success as being able to trust the instruments. Given the low initial power of ESS, the latter appears to be a realistic goal. A concern that may require action from ESS appears to be that several countries still have unallocated budget for in-kind construction contributions that cannot be reassigned as early operations funding. The result of shielding calculations resulting in a wall (and potentially roof thickness) of almost one meter (BEER) at a thermal-only neutron beamline appears somewhat high to several STAP members. The STAP suggests to compare results for shielding calculations from all beamlines and consider whether other technical solutions, e.g. radiation monitoring or chopper status interlocked with the accelerator (as implemented for instance at LANSCE) is a more economic option. ESS confirms that the instrument projects are on track per ESS project management. The STAP is pleased to hear the feedback from ESS/SAC that the “unfiltered truth” communicated in STAP reports is welcomed.

[We have not heard how the V20 beam line is utilized – Robin/Peter?]

For BEER, the STAP is pleased to see that Premek has moved to ESS, fully immersed into the planning and construction there, as well as his continuing efforts to engage industrial collaborators. While not fully resolved, it appears as if ESS has started to provide technical and legal support for this collaboration, e.g. by investigating the ISIS and ILL models for this type of collaboration.

The ODIN team has found a solution to keep Manuel Morgano engaged in the project and identified a replacement for Michael Lerche, who left at the end of March. A hand-over from Michael to Aurelio is planned for June, hopefully providing optimal transfer of knowledge. PSI points out that the in-kind contribution of imaging software development at PSI ends several years before the start of operations and either continuation as an in-kind project or a transition to DMSC should occur to have software development capabilities available when operation starts.

Having been an issue previously, at this time no concerns with communication between the two instrument teams and the ESS were expressed.

Charge

- To what extent is the progress of the instrument projects consistent with the planned timeline?

The STAP does not see any major problems or deviations from the timelines based on the information provided. Several moderate or minor issues (missing signatures required for procurement, shielding calculations on-going but required to determine cave design and procurement etc.) are addressed below.

- To what extent are the instrument projects on track for delivering early science?

Per Ken Andersen, the SAC (and presumably ESS) defines early scientific success as being able to trust the instruments, i.e. a thorough hot commissioning focused on benchmarking of the instrument capabilities and confirmation that the instruments fulfill their design goals. The STAP sees both ODIN and BEER team on track for this goal and based on previous, more ambitious goals to produce science that could be used for news releases to the general public, even ahead of this schedule.

ESS

Ken Andersen provided an update on the ESS overall project. Some installations in E01 are already happening –this is encouraging. While the projected timelines do not allow for any slack any more, ESS is aware that delays are likely to occur – a realistic assessment. ESS defines early science success as being able to trust the instruments. Given that the neutron flux will be not competitive with existing instruments in the first years, this is a realistic expectation that also serves to attract users once the available neutron flux is superior to other instruments, especially if these users can be engaged with the lower flux to prepare experiments utilizing the higher flux.

ESS moves into the initial operations phase from 2019 to 2025, requiring different types of funding than the construction or in-kind contributions and negotiations appear to be occurring. It was pointed out by the PSI team that policies and strategies regarding this transition might still need to be fine-tuned and communicated to the participating instrument teams. Several countries (Switzerland, Czech Republic) still have uncommitted funds for in-kind construction contributions that cannot be simply rededicated as early operations funds.

The ESS-driven common shielding project is moving forward. ESS confirms that the instrument projects are on track per ESS project management. The STAP was pleased to hear the feedback from ESS and SAC that the STAP reports are deemed useful, providing “unfiltered truth”. Both ODIN and BEER performed cave/hutch shielding calculations. It appears to be an opportunity for ESS to compile and cross-compare these calculations from all instruments to avoid unnecessary shielding wall thicknesses due to false assumptions or calculations. The STAP questions whether other technical solutions, such as radiation monitoring or chopper status interlocked with the accelerator (as implemented for instance at LANSCE) provide more economic options without compromising radiation safety. A benefit of an accelerator facility compared to a nuclear reactor is after all that the safety basis may allow such interlocks. While no decision appears to be made yet, the policies regarding industrial collaborations, specifically how industrial partners are rewarded with beam time when providing capabilities (e.g. Gleeble for BEER), will likely mimic policies from ILL and ISIS.

Previously voiced concerns that delays of procurements may occur due to ESS not providing information were not expressed again and the STAP assumes these issues were resolved. However, BEER and three other beamlines are awaiting signatures from German (?) authorities that hold up procurement of NBOA, which in turn could delay installation as all of these are required to be installed simultaneously. It might be worthy for ESS to consider negotiating this likely delay for four beamlines on a higher level.

We have not heard if a replacement for V20 after the shutdown of HZB was pursued to continue development of the for instance for diffraction instruments crucial new chopper and data reduction protocols. Previously voiced concerns about communication between instrument teams and ESS groups, e.g. DMSC, were not expressed again and the STAP assumes that the communication has improved. We have not heard any updates on the required beam monitoring for controlling the chopper cascades and whether these will be provided by ESS or not.

Action Items:

- The funding issues when moving from construction to early operation, that appeared to cause some uncertainty with the instrument teams, should be resolved. Similarly, a use for the still available in kind contributions should be identified.
- ESS should consider compiling the results of the shielding calculations as well as the shielding design resulting from those. Identification of outliers or a consensus would avoid unnecessary cost and increase confidence, respectively. Potentially, alternative technical solutions such as accelerator interlocked radiation monitoring can reduce cost for shielding for an unlikely worst case scenario at all ESS beamlines considerably. Since procurement of these components will start within a year or less, this should be given a high priority.
- BEER and three other beam lines seem to be affected by missing signatures precluding purchase of NBOA, potentially delaying four ESS beamlines. It might be useful for ESS to understand whether higher level negotiations rather than by the four instrument teams individually can resolve these issues?
- The STAP did not receive updates on previous action items from the October 2018 report from ESS. While the STAP did not hear concerns about these from the BEER or ODIN teams and the issues identified therefore don't seem to become road blocks, it would be still of interest to the STAP if e.g. a replacement for the V20 beamline is deemed useful by ESS, what the status of beam monitors for chopper and data reduction is etc. The STAP therefore requests and update of those items for the next STAP meeting.
- There is still uncertainty about what components of the beamlines need to be CE certified and whether ESS or instrument teams are responsible to do so. This should be resolved.
- ESS should solidify the pathway to reward industry for funding e.g. a Gleeble, e.g. by allowing to pre-pay beam time with hardware. Provide as much possible support for e.g. legal issues (ownership, liabilities) such that the instrument team can focus on the science case. Possibly also fund, or at least reward, similar outreach.

ODIN & BEER

Both beamlines are interfacing with the ESS project management and lead engineer. Allocation of resources for installations etc. appears to be on a good path from the information presented to the STAP.

ODIN

The STAP is pleased to hear that the contract situation for Manuel could be resolved, that a replacement for Michael Lerche was hired (Aurelio), and that a hand-over between the two is planned for June. The STAP stresses that this was crucial for the continuity of the ODIN project.

The ODIN team stated that the decision of a detector technology will be delayed as long as possible to be able to procure the most recent generation available. While the STAP agrees with this decision, we suggest to inquire with the potential vendors about their lead time and possible collaborations on technology developments and derive a drop dead date for the procurement from this information.

Action Item: Inquire about lead time for detector procurement and estimate date for procurement.

The ODIN team reported to be on track for providing documentation to ESS. In particular, the STAP commends the ODIN team that the hazard analysis provided by the ODIN team became an ESS-wide template for other instrument teams. The in-kind contribution of imaging software developed for ODIN should continue until the operation starts to avoid having no software expertise when actual experimental data is available. Negotiations between the ODIN team and DMSC are on-going.

Action Item: Find a solution for continuing the highly specialized imaging software development for ODIN with the goal to have software developers familiar with the code available when operations start.

Issuing of tenders, cave and hutch design, electrical design, shielding design appear to be on track for ODIN. A new, dedicated staff member for design (Jan Hoving) was hired at PSI. The VAT issue, a concern in the previous STAP meeting, was resolved. Also in the previous STAP meeting, it was reported that the PSI ODIN team will provide the PSI Tremsin detector for tests at V20, increasing the value of the test beamline. The idea was that the downtime of PSI in 2019 may free some resources for the use of V20. Since the energy/wavelength resolved neutron imaging is a crucial part of the ODIN concept, the STAP would appreciate updates on these test activities.

Action Item: Report on tests with Tremsin detector at V20.

The issues of the number and location of beam monitors for ODIN, reported as an unsolved question in the two previous STAP meetings, is still not resolved. There was no consensus previously whether the V20 beamline can help in solving this, at the same time it was stated that this does not jeopardize commissioning or early science. No update was given.

Action Item: Provide update on beam monitors as these may affect design as well as data reduction strategies.

The ODIN team presented ideas on early science and first experiments. Since imaging is distinctly suitable to communicate “scientific accomplishments” to the general public, the STAP commends these plans as they can provide “brownie points” from ESS to ODIN by providing positive headlines for ESS. While not utilizing the ESS beam in particular, characterizing famous objects the general public can relate to such as the Nebra disk, components such as nails from the Vasa ship, or parts of the destroyed Moranti (?) freeway bridge in Italy using neutron imaging are likely to cause the desired attention in the public. Outreach to plan such experiments should continue with the obvious caveat that scheduling high value samples such as the Nebra disk should only occur after operational reliability has been established.

BEER

The STAP is pleased to hear that Premek has moved to ESS in late summer 2018 and appears to be fully immersed in the ESS overall project. The STAP specifically commends Premek for continuing to reach out to industry for engagement in the BEER instrument and especially providing capabilities such as a

Gleeble machine. As a minor concern, the STAP notes that presenting the stress rig and dilatometer as “predominantly for academia” and the Gleeble as “predominantly for industry” might give the wrong impression to users. The STAP suggests to not create any impression that the two capabilities have different user communities. While the overall BEER project management has been integrated in the ESS project management, issues such as policies for industry engagement, the alignment of samples as well as the type of collimators (pre-fabricated fixed geometry vs. motion controlled slits) remain open. Both Premek and Jochen reported no major issues with issuing of tenders, procurements, designs (especially cave), reviews etc. Overall, the BEER project is reported to be and appears to the STAP to be on track for installation.

Action Item: Continue to work with ESS on defining policies to reward industry for providing capability (Gleeble) as well as long term engagement. Reach out to existing engineering diffraction instruments for information on their incident collimation solutions (what works, what would the teams at these instruments do better).

The BEER team expressed concerns that signatures by local management (not ESS) are missing that preclude purchase of NBOA. An alternative plan has been identified and since three other beam lines are affected by this problem, ESS might get engaged (see ESS action item above). The HZG B₄C detector development is on-going and a vendor for the required large area ¹⁰B coating has been identified, accomplishing this milestone. After the prototype system was successfully tested at V20 as reported in the previous meeting, tests with a laboratory neutron source as well as low-flux testing at TUM/FRM2 are on-going or planned. Since the STAP has not heard an update, the following item remains.

Action Item: Determine what types of alignment hardware and strategies are required, e.g. by discussion with instrument teams at other neutron stress scanners.

V20 ESS Test Beamline at HZB

No updates on the V20 test beamline were reported, neither how the remaining 6 months will be utilized nor whether a at least partial replacement is envisioned at another facility after the reactor will be shut down in December 2019. Given the insight gained from simulating chopper operations and data reduction as reported during the last meeting, an update for the next STAP meeting would be appreciated.

Action Item: Update the STAP on further tests on e.g. chopper operation, data reduction etc. to assess whether the somewhat complicated data reduction schemes will work on day 1 of ESS operations.