Sample Environment STAP Report – April 2020 – Draft

Chair: Elizabeth Blackburn (Lund)

Panel Members: Rob Barker (Kent), Marek Bartkowiak (PSI), Stefan Carlson (MAX-IV), Andy Church (ISIS), Yamali Hernandez (NIST), Stefan Klotz (Paris). Andrew Boothroyd (Oxford) was unable to attend the meeting.

INTRODUCTION

The STAP was held virtually, with presentations by all parties involved supplied in advance of the meeting. Discussions between the panel members and the Sample Environment Team at ESS were carried out by video conferencing. In this report, the first section is concerned with our primary concern, scheduling. The second section addresses the charge given for this session. The third section provides status updates on issues identified in our previous reports, where they are not covered in other sections. The fourth section covers other areas that we consider of importance.

SECTION I: Primary Concern - Scheduling

The Sample Environment team by necessity handles a large number of individual projects, of varying size. Due to delays from a variety of causes (most notably the delay in signing some in-kind contracts), there is now a very large amount of integration and commissioning work scheduled for the second half of 2022, and we are concerned that this will be difficult to handle effectively. Where possible, work from this block should be pulled forward.

In the presentations on the sections, the TEFI and FLUCO timelines presented did not clearly account for procurement times, integration times and commissioning time. For PREMP the in-kind contract is also not yet signed, rendering the timetable uncertain. There are clear crunch points in the schedule for these two areas (e.g. the end of 2022 for TEFI and FLUCO). Procurement of equipment accessories also needs to be factored in. Where mechanical integration (e.g. flanges) must be added at ESS, the time for this to be manufactured and implemented also needs to be considered. While the team leads claim to not be concerned about certain details, it will take planning, scheduling and execution to make sure that everything is ready in time. Experience from other facilities shows clearly that if not dealt with, this will become a big stumbling block.

Certain projects may fall through for external reasons. The scientific, technical and financial risks should be assessed here. TEFI should priorities purchasing (or sourcing from HZB/LLB) standard items as soon as possible (for example Orange cryostats, temperature controllers, thermometers, heaters, cables, indium wire, vacuum grease, vacuum parts, pumps, leak detectors, transfer lines, etc.) to reduce the timetabling issues identified above. This will also help in case of future budget cuts.

We identify three particular areas where action could be taken:

- ESS procurement are currently limited to one large tender at a time. This is already a problem for TEFI and will become a more serious problem.

- Each individual equipment project is owned by a particular team lead. This includes in-kind projects. In some cases, this means that individuals have ownership for a very large

number of projects. Care should be taken to make sure that no projects are left to one side. We suggest frequent 'traffic-light' monitoring of the status of all of the projects by the line manager. This may require clear internal project milestones for every project. Where projects overlap between the different teams, the ownership role (if not the actual work) should be assigned based on overall workload across the group.

- A risk analysis should be carried out to identify the most significant project risks, for both mitigation and planning. This should be within the cadre of prioritisation, and include delay information. For example, the MAGIC asymmetric magnet is a bespoke build, and the tender is expected to be issued in about six months. There is clearly a non-negligible design risk, as well as a risk that the company that wins the tender may eventually not complete the task.

SECTION II: Questions specific to this STAP meeting

Prioritisation and progress on 'Day 1' sample environment systems

For the critical first early science, the sample environment requirements are relatively basic. As a minimum, the first three instruments will require:

- LOKI – the small angle scattering instrument will need a sample changer
- DREAM – the powder diffractometer will require a sample mount; any parameter change that is available will of course be of assistance.
- ODIN – the imaging instrument will not require any immediate sample environment

This should all be easily achievable. For the science cases outlined in the instrument proposals, more advanced equipment is required, and the Sample Environment sections have considered this carefully. We were particularly happy with the information provided for PREMP, where a clear prioritisation order for the classes of items was given. For TEFI, prioritisation on the instrument level has been done, but the impact of this on the pool equipment prioritisation was not done. For both TEFI and FLUCO, there was no consideration of inter-instrument prioritisation. This is not required at the present, but given the financial situation this must be considered.

We also wish to emphasise that the focus on first science has shifted attention away from pool equipment items *as members of a pool*. We recommend that the current status of the pool components be cross-checked on a regular, if infrequent, basis.

Cutting-edge sample environment requirements are constantly changing, often in small ways. We suggest that the Sample Environment Team liaise with the Scientific Coordination and User Office (SCUO) to contact active user groups to keep tabs on current trends, particularly for lower-value items. This will also help SCUO in its build up, and as preparation for being able to supply information on sample environment to interested users. Examples that came up during our discussions were:

- magnetic reference layers to exploit polarised neutrons for soft matter.
- 3D printing bespoke parts at short notice.

Proposed strategy and ways-of-working related to mechanical integration, controls, safety, maintenance in view of schedule and available resources

Software

Anders Pettersson has been shifted from Sample Environment to the ECDC group concerned with ESS-wide software integration, and then seconded back to Sample Environment for 50% of his time. The creation of the ECDC group has been positive, and has led to a better structure and flow of work on integration, making it easier to identify where bottlenecks exist. This now needs to be incorporated into the scheduling and timetabling of work.

Mechanical

We have seen a small number of examples of mechanical integration such that equipment is ready for installation on the test beamline YMIR. The Sample Environment team successfully set the standards and requirements a few years ago, and will reap the benefits now. However, this needs to be implemented in a timely fashion. Much more of this can and should be done in advance, especially now that the team has access to in-house engineering resources (see status updates section).

Overall

The current plans now place a very large amount of this work in the second half of 2022, and we do not think that this will be feasible. This has also been identified as an issue by the DMSC STAP. We therefore encourage the Sample Environment team to move as much work as possible forward to try to avoid this build-up. This can be done by pushing forward integration (both software and mechanical) for items already existing, and skewing the purchasing profile earlier, where possible.

Progress on fitting and using on- and off-site sample environment workshops

Although we requested updated laboratory plans, we have only seen this for one laboratory in the TEFI area. We discussed this at some length during the meeting. Given the timeline, it is now too late for significant changes to the laboratory fit-outs to be made. However, there a number of unresolved issues that should be tackled as a real priority.

- Storage space - we were told that part of the experimental hall floor area has been marked off for use for equipment storage and for dewar storage. We do not consider this a desirable solution, especially this early in the lifetime of ESS, for workload and stock security reasons.
- The nitrogen supply issue in the FLUCO lab still needs a clear resolution.
- Laboratory plans should be available.

The container bunker facility presented to us is an interesting approach, and we look forward to seeing the results. Certainly, a bunker facility is required, and ESS has the possibility to make the bunker an integrated part of the building.

SECTION III: Updates on issues discussed in September 2019

1. **Health and Safety**
    a. Hydrogen gas handling came up in our discussions, specifically with respect to H_2 gas handling in the FLUCO activity. It was not clear that the formalities surrounding ATEX/Ex zone classifications for working areas have been taken into account at present, and the details on, for example, the hydrogen gas pressure required in FLUCO, were unclear. During this meeting we did not specifically discuss hot work areas; our previous comments apply here.
    b. We did not receive an update on licensing and radiological safety, but this has been covered in the Samples and Users STAP and we will be able to discuss next time if necessary.
    c. The Sample Environment team should be more familiar with the sample handling and safety procedures that have been developed by Monika Hartl. The team needs to consider storage requirements for activated pieces of equipment (including e.g. sample cans). Active cupboards need to be present at each beamline.

2. **General operation of the Sample Environment Team**
    a. We are pleased to see that the group leader position has been advertised (early 2020). This person will be very important at this stage, to weld the various activities together, monitor cross-training, and handle personnel management. We emphasise that it is very important that a person with the *appropriate* skills must be selected.
    b. A work environment and personality diversity exercise was originally scheduled for this spring, but was cancelled due to Coronavirus.
    c. There was a significant re-organization at ESS last autumn. The primary impact on the Sample Environment team so far has related to software integration issues; this has been discussed above.

3. **Collaboration with instrument teams**
    a. For instrument-specific equipment, there must be good communication between the Sample Environment team and the instrument teams. There are examples where this is clearly close collaboration (e.g. MAGIC), and other areas where this is not the case (e.g. DREAM). We are particularly concerned about the instrument-specific cryofurnace projects for DREAM and CSPEC, where TEFI need to be much clearer about the requirements.

4. **Engineering resources**
    a. The decision to dedicate some mechanical engineering manpower to Sample Environment and the Scientific Activities Division more generally is welcome. This will help the team, as they are not designers by trade.
    b. The issue of the second non-expert CAD package for internal use remains live.

5. **Engagement with other facilities**
    a. We are pleased to have seen specific, positive examples of this engagement with all of the activities of the Sample Environment Team. This should be the normal situation for this team to work.

6. **In-kind contracts**
    a. The signing of contracts and technical annexes still takes a long time. Uncertainties here are introducing a level of fragility to the procurement and commissioning plans for the sample environment. The level of communication between in-kind partners and their contacts on the Sample Environment team is quite variable.
    b. FLUCO is handling a much wider range of in-kind partners than PREMP and TEFI, and insufficient timetabling information was provided to give confidence that this is all in hand. We are concerned that some of the projects are siphoning resources away from key activities. Are there enough people and enough lab space to receive all this kit at the time it arrives and integrate it in time? We would like to see a better staggered timetable, including for testing on site.

7. **Handover of activities to other parts of ESS.**
    a. We did not receive much information on the planning in advance of hand over to Conventional Facilities. This is particularly true for the helium management situation (see separate topic).
    b. We encourage adoption of the EAM (asset management system).
    c. How will compressed gas bottle storage be handled?
    d. When will decisions on ventilation capabilities be finalised?

SECTION IV: Additional Points to Consider

Helium Recovery System

Information on the broad outlines of the system were presented. The liquefier already exists as a part of the accelerator construction, and is operational. The main pipework tracks have been identified and presented to us, and detailed design on the central pipework is slated to start soon. This will be done by the Infrastructure Group in consultation with SAD. The next steps for the Sample Environment Team have been identified as:

- A temporary solution for He recovery at E03 should be considered. Otherwise, a global helium shortage as seen last year will impact the TEFI equipment commissioning.
- Specification, design and procurement for instrument, workshop and parking station connections.
- Development of a helium management system based on the systems at HZB/ILL/ISIS/etc.

We need a clear statement of which parts are Sample Environment's responsibility, as well as the timelines for this to be done, including procurement. TEFI have the responsibility for making sure this is ready for use by Sample Environment, and need to monitor accordingly.

Maintenance and operation after construction also need to be decided upon. If this is not done, the ensuing workload will fall on TEFI, and so TEFI need to actively pursue this.

We are disappointed that a pressurised helium network will no longer be provided. The decision that helium gas supply will be only available locally at each instrument will affect the future workload and handling procedures. In particular, there will be a serious manpower commitment involved in moving around the full and empty gas bottles. At this point we would ask to claim space in the piping concept to foresee a fit-out at a later stage.

Documentation and Record Keeping

PREMP have prepared detailed documentation, and are considering procedures for maintaining this to fulfil their legal obligations. FLUCO specifically mentioned calibration schedules and wiki pages for maintaining equipment information. TEFI's plans were not outlined. All three of these sections should adopt a uniform approach. This will assist with the necessary cross-training required for the shift to operations.

SECoP

We agree with the proposed approach to carry out standardised system tests, and to use the comparison to decide whether or not to continue with the implementation of SECoP. We think that this decision should be made as soon as possible to avoid duplication of effort.

Electrochemistry

The development of the electrochemistry activity is very welcome, especially in its role as a bridge between SULF and Sample Environment.

SUMMARY AND CONCLUSIONS

The STAP appreciates the information provided by the Sample Environment team, and recognises the additional workload occasioned due to the meeting being held remotely.

The work done in the past few years on standardisation and common requirements is now paying off, and the team should be very pleased with what has been achieved here. Prioritisation for first science is clearly being taken very seriously; we have provided some suggestions on how this could be improved further.

The team have made a lot of progress over the last six months, but we are seriously concerned about the scheduling plans over the next 3 years, and the impact that will have on capacity for integration of equipment; we have provided some suggestions on how to mitigate the associated risks.