

## **ESS Diffraction STAP Report from 25 October 2022 Meeting**

STAP met at ESS with ESS staff and instrument teams present. STAP members participating in person were M. Angst, P. Attfield (chair), M. Sahlberg, G. Rousse and T. Fennell. H. Playford and K. Page joined by videoconference. R. Neder was absent.

A site tour was enjoyed by STAP members present at ESS with excellent progress on buildings (notably the DREAM Cave and Cabin) and scientific facilities evident.

STAP received an update on recent ESS developments including the SAC report on ESS Detectors and presentations from the DREAM, MAGIC and HEIMDAL project teams.

STAP thanks all ESS staff and the instrument teams for their continuing hard work and for the high quality of reports and presentations. Recommendations in the following report are indicated R and are also listed separately at the end of the report.

### **ESS management session**

- STAP notes that excellent progress is being made on the overall ESS project.
- ESS focus on BoT (ideally for 5/25) so that neutrons are available as soon as possible is welcomed by STAP. R
- ESS progress on common projects is noted very favourably, with continuation encouraged to avoid any instrument project delays.
- The possibility to explore short pulse/high current modes of initial ESS running would be very well suited to the Diffraction Suite instruments and STAP would welcome this as a way to perform ambitious experiments, e.g. on very small samples, during even early stages of HC. R

### **Detector reports**

- The SAC Detectors report and a report on performance of the CDT detectors to be used on Diffraction Suite instruments were welcomed by STAP. STAP thanks all those that contributed to the review and associated reports.
- STAP endorses the SAC Detectors report but notes that CDT detectors to be used in Diffraction suite instruments have shown good progress across all tests conducted to date. There remains a small uncertainty for long term performance under operating conditions but reasonable mitigation has been done.
- Continued testing of detector modules especially making use of opportunities at pulsed sources will be very worthwhile, e.g. forthcoming test of a MAGIC detector module at ISIS, and in situ tests of DREAM modules at ESS anticipated from 3/23. R
- Monitors for initial Diffraction suite instruments are also being designed and tested by CDT. A simple robust design is being followed and has performed well to date. Read-out electronics from the CDT detectors has recently been connected successfully to standard ESS/DMSC modules.

## Diffraction instrument suite

### DREAM

DREAM is a versatile powder diffractometer that will tackle chemistry, physics and materials problems. STAP has previously emphasised high resolution powder neutron diffraction as the main direction for the initial science programme.

- STAP noted outstanding progress across all areas of the instrument build project (progress on NBOA, bi-spectral switch, guides and shielding, choppers, heavy shutter, detector manufacture, sample vessel, cave, installation of detector supports all excellent with no delays envisaged). The first detector modules will be installed in 3/23 and tested in situ. DREAM remains on schedule to be one of the first completed ESS instruments, and provides a powerful visual impression of how the eventual instrument areas will appear.
- The increasing need for ESS DREAM staff to spend time in and around the instrument area would justify having a devoted DREAM office in E01 close to the instrument. R
- Previous calls for construction of a cryofurnace with 20 sample changer project from the LLB partner have failed to secure a viable bid. The project is now redirected via the ESS SE group and a small manufacturer may be interested in working up a construction project – this approach is strongly supported. R

### MAGIC

MAGIC is a single crystal instrument for tackling magnetism and correlated electron problems using polarized cold and thermal neutrons.

- STAP noted excellent progress across the project. Work on many components (solid state bender, choppers, guide system, heavy shutter, detectors, polarisation analysis including XYZ, and cave) is going well with no apparent roadblocks. A detector module will be tested at ISIS. Design of the vacuum housing has been delayed by lack of staff resource at LLB, and this project will be subcontracted externally to avoid risks of overall delay to the build. Work to develop data reduction and analysis software with DMSC is on track.
- A successful bid for the elevator next to the MAGIC cave has not yet been obtained and alternative solutions such as a goods lift (taking equipment but not people) are being considered. This is an important but not critical part of the MAGIC project build.
- No permanent MAGIC staff are currently based at ESS although several people are soon to be deployed; Xavier Fabreges will be 50% at ESS from 3/23 and ESS will provide an IPL. Staffing at ESS is considered by STAP to be an important issue for the near-term future, and a full-time instrument scientist at ESS should be appointed by late 2024 (or earlier). R

## **HEIMDAL**

HEIMDAL will offer a combination of powder neutron diffraction, small angle neutron scattering (SANS) and neutron imaging to enable complex and evolving systems to be studied over multiple length scales.

- STAP notes excellent recent progress of HEIMDAL plans (NBOA, choppers, T0 chopper, caves, guides and shielding).
- A manufacturer (SwissNeutronics) offer to include both the thermal and 116 m (around 75% of the total length) of the cold guide within the same shielding is welcomed. This provides an outstanding path to later upgrade that will enable the original science case of Diffraction + SANS + Imaging to be achieved in the future. Acceptance of this offer is strongly endorsed by STAP and it appears to avoid the need for a change of scope request. R
- Engineering support for the project is becoming critical. A forthcoming 2-year appointment will help but appointment of a new full-time engineer to replace an expected retirement will also be important. R

### **Summary of Diffraction STAP Recommendations**

1. ESS should focus on BoT by 5/25 so commissioning and neutron science can start as soon as practicable.
2. Explore short pulse/high current modes of initial ESS running to enable early science on Diffraction and some other types of instrument.
3. Test detector modules as practicably possible in coming years e.g. forthcoming MAGIC module test, DREAM modules to be tested at ESS from 3/23.
4. Provide a dedicated office for ESS DREAM staff in E01 close to the instrument.
5. Redirect the DREAM cryofurnace with 20 sample changer project via ESS SE group and engage with a small manufacturer who may be interested in this construction.
6. A full-time MAGIC instrument scientist at ESS should be appointed by late 2024 (or earlier).
7. The HEIMDAL guide offer to include thermal and 116m of cold guide should be accepted. This provides an outstanding path towards a later upgrade enabling the original science case of Diffraction + SANS + Imaging to be achieved in the future. A change of scope is not recommended.
8. Engineering support for the HEIMDAL project is becoming critical. A 2-year appointment will help but appointment of a new full-time engineer to replace an expected retirement is also strongly recommended.