ESS Diffraction STAP Report from 12 October 2021 Meeting

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

STAP received an update on recent ESS developments and presentations from the DREAM, MAGIC and HEIMDAL project teams. STAP thanks all ESS staff and the instrument teams for their continuing hard work during current restricted times, and for the high quality of reports to this meeting.

ESS management Q&A session

- STAP notes that excellent progress is being made despite delays to the overall ESS construction and start-up projects.
- A rebaselining exercise is currently underway and it is likely that BoT will not be until late 2025, with instruments' HC and FS in 2026 and SoUP in 2027. First Science and User Community expectations will need to be managed accordingly.
- STAP has postponed planning for HC and FS experiments in view of the above delays, but previous recommendations remain valid.
- It is likely that several instruments such as DREAM and MAGIC will finish their construction phases 2 years or more before their HC. It will be important that ESS makes active plans for CC to be done as fully as possible, and for the instruments to be maintained in a 'neutron-ready' state without loss of function or knowledge from the construction phase.
- Costs of common ESS Projects – such as Electricals, PSS and Utilities – are needed soon by the instrument build teams.

Diffraction instrument suite

DREAM

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

- STAP notes continuing excellent progress across the instrument build project with no critical risks apparent. The NBOA has been delivered and proposals for the bispectral switch Si-wafers to be characterised are submitted to SNS and ISIS. A bid from MiCo to build the Cave and Hutch has been accepted. DREAM remains on schedule to be one of the First Three completed ESS instruments, with end of the construction phase expected to be in March 2024.
- Relocations of Mikhail Feygenson (instrument scientist from FZJ) and Sylvain Desert (lead engineer from LLB) to ESS are welcomed. The move of Florence Porcher (instrument scientist from LLB) to ESS is under discussion and STAP hopes that this can be arranged soon. Relocation of this team to Lund will provide excellent local support for DREAM.
- Provision of a 20-sample cryofurnace is still supported, but STAP notes that two initial calls for tender failed to produce a viable bid. A third call with more relaxed specifications has just been issued. If this also fails to attract bids then fallback options such as using gas blowers may have to be considered. However, STAP notes that the Cryofurnace could be decoupled from the main DREAM project at TG5 if more time is needed to discuss specifications with potential manufacturers, as there is no urgency in having the Cryofurnace ready before ESS neutrons are available.
- Test results on modules from the mantle part of the DREAM detector at the TRIGA-Mainz reactor sound positive but STAP would like to receive a report, as requested in April 2021. Some technical issues such as shorting of the electrodes in large detector segments appear to have been sorted out, but it will be important to have these documented, especially as the CDT technology is being applied across all three Diffraction suite instruments.
- Costs of common ESS Projects – for Electricals, PSS and Utilities – are needed soon.

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 almost all areas of the project. Some delays are apparent but MAGIC is still expected to be complete by March 2024 and so will be amongst the first 5-10 instruments ready in good time for ESS neutrons.

- Wide-angle polarisation analysis is an important part of MAGIC capabilities. The design of a strong saturating magnetic field (1000 G) over the volume of the detector is noted favourably. This is robust against stray fields and does not need a remagnetising device, which will simplify maintenance and operation. As reported in April 2021, risks in performance of the originally-proposed solid state analyser have led to an alternative design based on air-gap technology with glass substrates being considered. Studies of the two devices are ongoing and STAP awaits a comparative report before or at the next meeting. A Change of Scope request may be needed at sub-TG3 review for a revised polarisation analyser design.

- STAP notes that the initial tender for Cave manufacture did not attract any bids, perhaps because of the large size of this Cave. A revised call is in progress and it may be useful for the MAGIC team to discuss with DREAM and HEIMDAL, both of which have Cave suppliers in place.

- Cost estimates from ESS for Electrical Utilities and PSS are needed by the MAGIC team.

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. Separate guides and detectors for the cold and thermal neutron spectra are planned. STAP continues to support the original science case to which the simultaneous measurements are fundamental.

- STAP notes continuing excellent progress of HEIMDAL plans. A bid for the Cave construction has been accepted.
- Dan Mannix is congratulated on being appointed to the Instrument Scientist position for HEIMDAL at ESS. This provides stability to the project.
- Progress on gathering costs to inform the proposed Change of Scope to the HEIMDAL guides is noted positively, however this issue is now long-running and needs action by the HEIMDAL team and ESS to achieve a resolution. STAP would like to see any revised plan for the instrument build by the next meeting in April 2022 so it can be incorporated into the wider rebaselined ESS schedule.
- STAP continues to recommend strongly that the original science case of Diffraction + SANS + Imaging be achieved as early as possible. The expected delay to HEIMDAL SoUP until ~2028 makes the case for building the hot and cold guides together to provide Diffraction + SANS more compelling. This might attract external funding from partner universities to add the Imaging capabilities, as done with RAC support for polarisation analysis on DREAM.