

ESS Spectroscopy STAP Report

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This a response to reports received by the instrument teams, the detector group, and the data scientist. No online STAP meeting was held at this time.

General observations

For the most part, the reports are about the progress made with specific instrument components during the last ~6 months. There is a lot of positive momentum, but we are unable to judge, even at a high level, the actual status of the projects.

Photographs in the BIFROST, CSPEC and MIRACLES reports greatly enhanced the value and accessibility of the reports.

Originally, STAPs were set up with the goal to give scientific and technical advice to ESS. Looking back over 10 years of regular meetings, this STAP feels good about what we have accomplished. We have helped ESS evaluating instrument proposals, with the instrument selection process, and early toll gate reviews. We have shared our experience to enable instrument teams to build the best possible instruments, and to set them up for success. Now that instrument projects are being executed, the nature of advice that ESS instrument teams actually need has changed. ESS now needs advice from people who are experienced running projects, and who have access to inside project status information. STAP members are senior scientists who know scattering science, but are less experienced running construction projects. This STAP is not set up to give ESS the advice they need, both in terms of what we know, and how far away most of us are from Sweden.

We recommend that ESS reconsider the role of the STAPs. We may not be very useful until ESS opens a new call for instrument proposals.

BIFROST

The BIFROST project team is reporting very good progress on many major project components. Most of the instrument design is expected to be finalized by the end of the year.

Instrument infrastructure components, such as electrical, utilities, and safety system, are awaiting final offers by ESS and are still unbudgeted and unscheduled. It feels like it is becoming urgent now to get this sorted out.

The instrument cave is installed and complete. 2022 will see many acceptance testing activities and the installation of many guide and shielding components. Regarding BIFROST guides in the bunker, the report states "Installation complete by June 22, ESS may need to remove installations afterwards for Target installation works". Can this be clarified? Will it be necessary to remove BIFROST installations for ESS target installation?

We are wondering if BIFROST relies too much on Cd for thermal neutron shielding which becomes transparent above ~250 meV. We recommend this be revisited.

CSPEC

Quality assurance measurements for guide pieces have been moved from FRM-II to PSI. The guide manufacturing continues to make progress. However, we are wondering if the delays in guide production and guide tests due to COVID restrictions have an impact on the project schedule?

The report goes into some detail about the lifting system for a shutter and a monitor, and the various beam monitors planned. Because this component could be similar for all spectrometers, we recommend that the team interact with other instruments about technical solutions.

CSPEC and T-REX teams are discussing a common technical solution for an optimized normalization monitor for both instruments.

A critical test of the multigrid detector is planned at LET (ISIS) in April 22. The entire production of the detectors for CSPEC hinges on the test results. We welcome the clear specifications and requirements for a successful detector test. This is an essential step towards a decision for which type of detector technology will be chosen. The decisive LET tests will come unfortunately very late, especially if a strategy change should turn out to be necessary and therefore such a clear paper is necessary.

The French project partner (LLB) agreed to make an additional in-kind contribution to the project in the form of a 12T cryomagnet.

We are wondering if the team could provide an update on the combined losses through all aluminium windows along the beamline and gaps for monitors and shutters. One of us recalls that this was looked at a long time ago.

TREX

Very brief report with progress updates on a number of components. The NBOA is currently in production and the delivery to ESS expected by end of 2021. The CTV is approved for the in-bunker guide, bunker wall feedthrough, out-of bunker neutron guide, and the pulse shaping and monochromator choppers.

Guide delivery and installation activities stretch into late 2024 which makes a project completion by June 2025 unlikely.

Is the project ready for in-bunker component installations? The BBGOA seems to be late in this respect?

The formal procurement process for the detector tank will be repeated. Fundamentally, the issue with vendors not guaranteeing the magnetic permeability is unresolved, but FZ Jülich and

ESS performed tests to increase their confidence in the choice of materials. We are wondering why it did take so much more time for preparing a re-run of a European call for tender?

The design of a neutron detector prototype is complete. The team expect delivery within one year. What does the schedule look like for the completion of the detector system overall?

MIRACLES

The team provided a nice overview of the instrument project status in the form of an annotated instrument figure. There is good progress reported for most tasks.

The NBOA is ready for delivery to ESS. The in-bunker guide bids will be evaluated in October, and the out-of-bunker guide procurement will be launched at the end of October. Can we get an update on the decision of the choice of provider for the in-bunker guide?

The MIRACLES choppers will be developed by Aernnova. An Integrated Design Review will be held by November.

The detector vessel contract was awarded, and an Integrated Design Review will be held in December.

We welcome the intention to install the in-bunker components prior to BOT. However, the plan is very ambitious, and we see potential risks

- with the in-bunker chopper (also in view that Aernnova is a new player in this field; for example, T-REX states 3 years between CTV and FAT),
- its interfaces with the guides, monitor, the in-bunker guide delivery (including housing, alignment, support - still in prototyping?)
- and the BWI (still under design, according to the report).

What are the consequences for the global project schedule if problems should arise, especially if potential component irradiation need to be considered after BOT?

The ^3He tubes with a U-shape connection were designed by Reuter Stokes. Detectors and electronics are to arrive later this year. System integration tests will follow BIFROST which has a similar system.

MIRACLES has formally agreed to participate in the ESS Beam Monitor Common Project. Monitors location, performance requirements, and technology choices have been set.

IDRs for the secondary spectrometer and the cave, envisaged for December and January respectively, are in time.

More information would be desirable concerning the analyzer crystal assembly (a prototyping had been suggested a year ago) and the situation of staff (engineer, scientist, data science).

A question from the previous STAP report concerning data modelling was not answered. A commissioning plan has not been provided.

Instrument shutters and lifting monitors: Interact with other instruments. These components could be similar for all spectrometers.

VESPA

The team estimates that the project is currently delayed by 10-14 months, mainly for administrative reasons between the Italian project partners.

The ESS common chopper project will cover the VESPA choppers.

Shielding calculations for the cave have been completed, showing that 60 cm walls will be required (in some parts). Figure 2 reports neutron doses but we believe it is quite important to check gamma doses as well – has this been done?

The impact of the HOPG mosaic spread was further analyzed in detailed McStas calculations, but the team doesn't reach a final conclusion/recommendation.

Instrument Data Scientist Report

For the first time, we received an Instrument Data Scientist Report (by Greg Tucker, who is assigned to BIFROST and CSPEC). This is good to see as the software integration (reduction and initial analyses following an experiment) is essential for scientific success. The report focuses on current development work of a suitable event data format and user interaction and workflow.

The Instrument Data Scientist seems to be well integrated with the BIFROST and CSPEC teams.

The report summarizes the basic processes for converting event mode data into a histogram of the differential cross-section as a function of (Q, ω) . This procedure is well established and implemented at other spallation sources. What would have been more helpful is to have the view of the IDS on whether any new or different procedures are being considered at ESS, and what are their advantages to the user over what is already done elsewhere. CSPEC and BIFROST are expected to open a new era by doing experiments at several energies in parallel (RRM or stacked analyzers). Certainly, the software will reflect this somehow?

Detector Group Report

An update from the detector group was received, with details on the multi-grid pilot test at LET (planned for early 2022), procurement and production status of key detector components.

A prototype of one column of the TREX design is ready for assembly, awaiting the outer vacuum vessel.

On behalf of the STAP,