# Updates for DREAM instrument (October 2023)

The following report describes the major activities of the instrument project since the last STAP meeting in April 2023.

**Recruitment**
Florence Porcher has started at ESS as a DREAM project scientist. The recruiting for the scientific associate for DREAM is ongoing.

**Schedule update**
The current planning still assumes a complete installation of DREAM (Final TG5) by July 2024, which is still before the current beam-on-target (BOT) date estimates (2025). However, ESS has scheduled additional number of the safety and user-readiness reviews after Final TG5. The scope of the reviews is being discussed, but they resulted in the DREAM project appearing on the critical path of NSS.

**In-bunker optics: NBOA, BBG and Bi-spectral switch**
The neutron beam optical assembly (NBOA) and bridge beam guide (BBG) were manufactured by SwissNeutronics (SNAG). The NBOA was delivered to ESS and integrated into the neutron beam port insert (NBPI). The installation of NBPI inside the bunker was completed. The bi-spectral switch was manufactured at FZJ and tested with neutrons at ISIS in July 2022. Additional measurements were taken in May 2023 for the switch with improved mechanical assembly of the wafers. The final report was completed and the switch was delivered to ESS.

**Neutron guides**
The last piece of the neutron guide in the cave was installed and leak tested. The part includes set of the slits integrated into the guiding magnetic field for the polarized neutrons (Fig. 1). This last installation completes the installation of the entire DREAM neutron guide system inside and outside of the bunker.

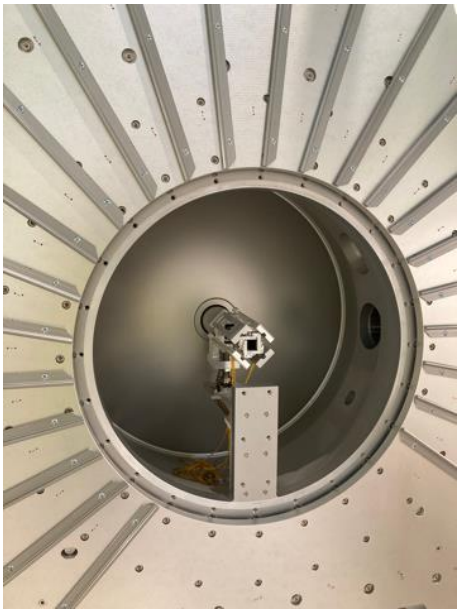

*Figure 1: Last piece of the neutron guide inside the cave*

**Neutron guide shielding**

The DREAM instrument is a part of the ESS Common Shielding project. The shielding blocks were manufactured and all blocks were delivered to ESS. The upper blocks were installed to cover the outside bunker neutron guides.

**Chopper system**

The housing and base of pulse-shaping (PSC) and band-control (BC) choppers were manufactured at the Jülich Chopper group and delivered to ESS. The PSC and BC choppers were fully assembled at the testing stand in Jülich (Fig. 2). The spinning of all disks within PSC chopper assembly to the target speed was successful.

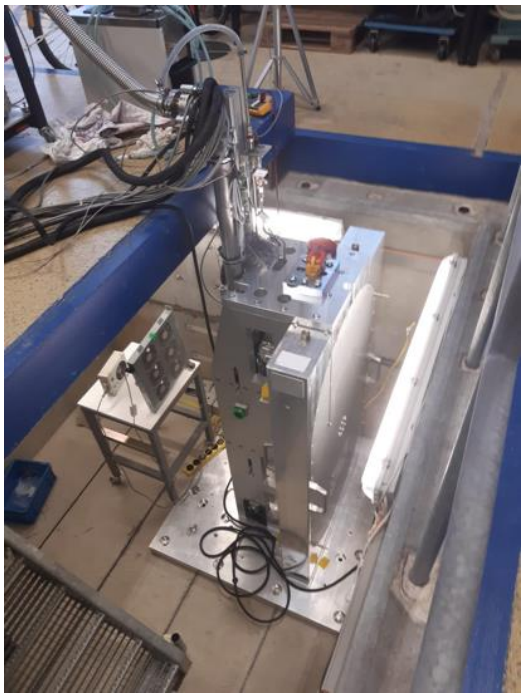

*Figure 2: Fully assembled pulse-shaping chopper at the testing stand at FZJ*

The BC chopper with a newly manufactured hub of the oval shape will be tested in a few weeks. Depending on the results of the tests, PSC and BC choppers will be shipped to ESS together or separately. Any potential issues with BC chopper will not affect the installation of the PSC chopper at ESS, scheduled in November this year.

After the installation of T0 chopper, it was discovered that epoxy used for the grouting of the chopper base did not set. The chopper will be removed and epoxy reapplied. We see no impact of this setback on the instrument delivery schedule.

**Detectors**

The manufacturing of the endcap detectors is complete, for the mantle detector and the high-resolution backscattering detector it is still ongoing.

During recent factory acceptance tests at CDT GmbH with cosmic neutrons, some of the detector modules have shown an increased background level compared to earlier produced modules with a count rate approximately twice of the usual cosmic neutron background. The issue was reported to ESS detector group. Finally, all assembled modules were accepted since they still passed the quality check for which we have required an average background noise limit of 1 mHz per voxel. In a thorough analysis by the company, the origin of the background was traced backed to the miniscule uranium contamination of some of the coated cathode sheets. The background originated from the grinding balls made out of zirconium dioxide that had traces of uranium at level of few ppm. The balls were used to mill depleted $^{10}B_4C$ sputter targets for recycling. The decision was made to replace all contaminated cathode elements that have not already been assembled, and further to replace the sputter targets to avoid such additional noise in the detectors for future production. The contaminated detector modules will be strategically installed in background-ridded areas of the instrument.

The endcap detectors will be shipped first to ESS Detector group testing facility at Utgard in Lund. The preliminary tests using ESS readout electronics with cosmic neutrons will be carried out. We cannot ship the endcap detectors to DREAM and install them right away, because the active construction in the DREAM cave is ongoing (see next section). Mantle detectors are too large to be tested in Utgard facility. They will have to be delivered directly to the DREAM site at ESS. Before they can be delivered the detector rack has to be installed, as well as all CUP installations shall be completed. The CUP installation tests include the testing of the pipes with a running water, so we would like to avoid having detectors nearby.

**Common projects**

The DREAM instrument is part of a common utility project (CUP) and a common electrical project (CEP). Both projects are led by ESS with input from the instrument team. As names imply, both projects will deliver necessary gas, water and electrical supplies to experimental caves and control hutches. CEP team has completed the installation. CUP team has started the installation, which supposed to be completed by November this year.

**Sample environment**

The scope and budget of the DREAM-specific sample changer cryofurnace were moved to the ESS sample environment group, with the DREAM team taking a lead role in procurement and contract negotiations. The DREAM team and sample environment group have reviewed the solution suggested by the CryoVac. We are expecting the official quote in order to proceed with the procurement.

**RAC and polarizer**

The cold neutron polarizer is the additional scope recovered with RAC funding. The polarizer support was installed inside the cave. The critical design review with ESS was completed in September. Approve to manufacture was received.

**Detector coverage upgrade**

During the last ICB meeting Pascale Deen have presented the benchmarking of all ESS instruments, including DREAM, against existing and future instruments during the first days of operation. It became clear that DREAM instrument with the current detector coverage and low ESS power will not be competitive until ESS reaches at least 2 MW. There is a possibility to use the ESS construction budget contingency for the full detector upgrade which will enable much a broader science case for the user program in 2027. We have provided a document detailing the need for the full detector coverage upgrade for DREAM, which was reviewed by Werner Schweika and Pascale Deen. The document is being reviewed by the ESS Science Director for the following hand over to the ESS Director General.