CSPEC STAP report 1st October 2021

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CSPEC is the cold chopper spectrometer of the ESS. We expect to finish the instrument cold commissioning (i.e., to have our final tollgate, TG5) in December 2023. In this STAP report, we provide an overview of the status of the main components. Replies to comments and requests from the previous STAP report are provided within the report.

FAT = Factory Acceptance test
SAT = Site acceptance test
CTV/TG3/IDR = Internal ESS reviews
KOM = kick off meeting
PDR = Preliminary Design Review

Guides, guide housings and alignment

To date, we continue to manufacture guide pieces. However, the production and FAT/ SAT have been delayed due to the problems at the FRMII reactor that makes it impossible to perform the quality tests. An alternative solution has been found and reflectivity measurements of the supermirrors will be tested at PSI.

We received the second and final batch of components of the outside bunker housings. The CSPEC team together with the NSS technicians and the ESS vacuum group have inspected and tested them. 20 m of vacuum housings were mounted on top of the CSPEC common shielding blocks as a testing setup to check the mechanics and test the vacuum. The inspection and tests were overall successful with only minor problems (e.g., a broken screw in one of the housing) which were taken care of. The tests showed the need to clamp the end housings for stability. The solution was transferred into the design of the in-bunker housings as well.

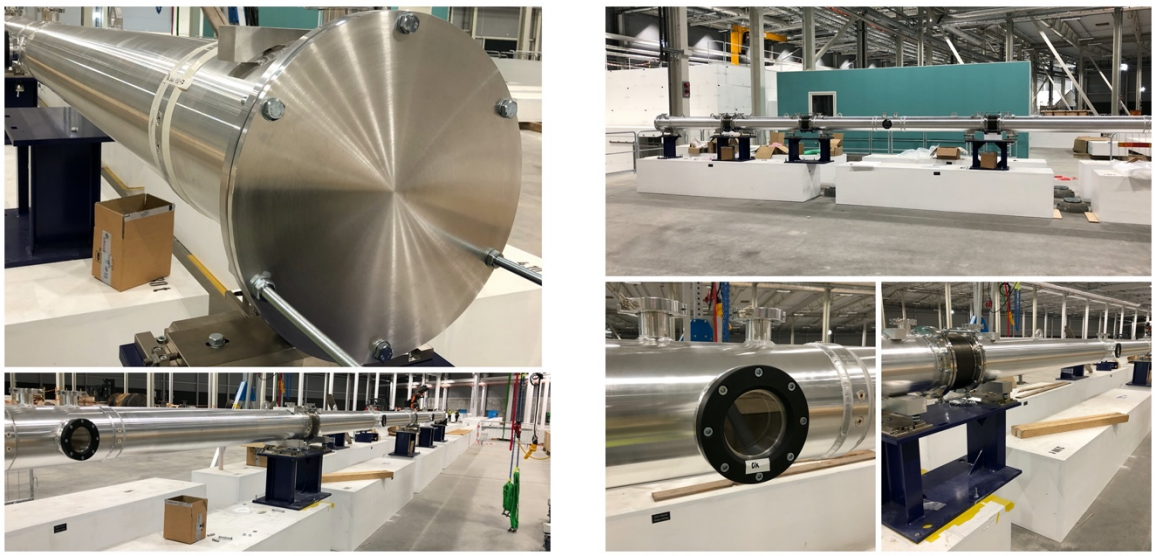


Figure 1. Overview and details of the 20 m of guide housings mounted for the tests.

A detailed installation and alignment plan is under discussion. The piles in the E0 buildings are not electrically isolated from the building (contrary to the requirements of electrical isolation by ESS to SKANSKA). Technological solutions for their proper electrical isolation are being evaluated before the guide installation.

Instrument shutter and monitor lifting system

The initial design for the instrument shutter and monitor system, 28.5 m from moderator, has been substantially changed to allow maximum flexibility in terms of allocated space (and thus technology) for the beam monitor. The IDR was submitted and a prototype is being constructed and will be tested at TUM.

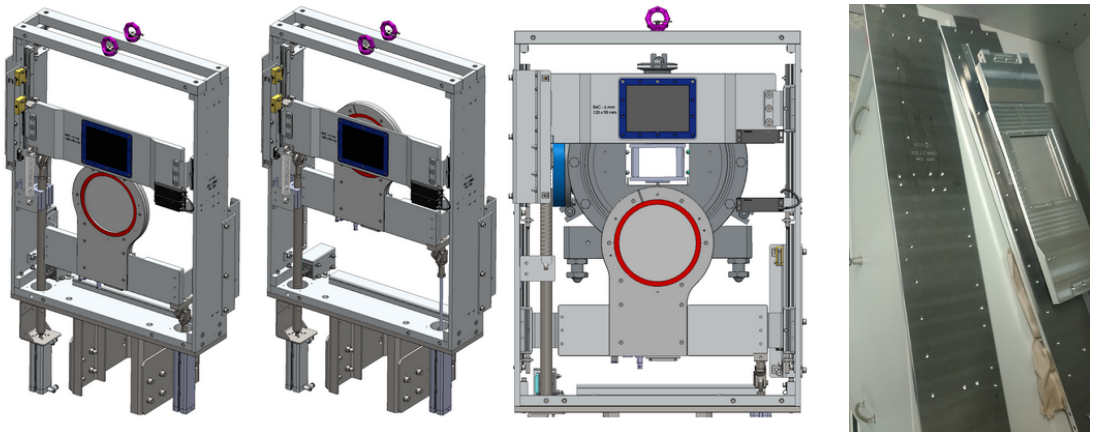


Figure 2. Updated model (left) and pieces from the prototype (right) of the shutter and beam monitor lifting system

Beam Monitors

An updated offer, with technology suggestions for the different positions (see table), has been received in June. There remain a lot of issues to clarify. Discussions with the detector group are ongoing, as well as the discussions with the T-REX team regarding an optimised normalisation monitor for both instruments.

BM	zone	Proposed technology	Fixed/movable	CSPEC comments
0	6 m, in bunker	Ionisation beam monitor (IBM)	Fixed	It would be good to have a consistent choice among the different spectrometers. However, being fixed in the beam, minimal impact on the beam is priority and IBM seems to be promising for that.
1	28 m, after BandWidth chopper, with the shutter	Fission chamber or Gas Electron Multiplier (GEM)	Movable (automatic system)	It would be interesting to understand the cost-benefit ratio for 2D GEM compared with single counter GEM. Since it will be removed during the experiments, we are less concerned about absorption and scattering effects.
2	105.6 m, after Pulse Shaping chopper	GEM	Movable (automatic system)	Same comments as for BM1.
3	158.5 m, after Monochromator chopper	Multi Wire Proportional Chamber (MWPC)	Fixed	We agree that it is a suitable solution. However, we need to have more details about the design. Concerns regarding the efficiency and saturation with the very different fluxes due to different instrument setups and source power.
4	After sample	MultiTube	Movable (by hand)	Concerns regarding spatial resolution and budget. We would like to investigate the use of a neutron camera, at least as an initial solution.

STAP Comment: It now seems to be too late for an optimal integration of the monitors into the engineering guide design.

We agree that the delay in the definition of the monitor specifications is not optimal for the integration of a suitable monitor into the design of the guide post the monochromating chopper. We feel that this is very unfortunate. The monitor group is trying to limit the Aluminium windows of the MWPC monitor. In addition, it is expected that the radial collimator will limit spurious scattering from the monitors and windows. Monitors 1,2 and 4 will be moveable to limit flux losses. The space planned for our guide gaps and in our lifting systems allows for a certain flexibility in the monitor design.

Shielding

Most of the shielding blocks for the primary spectrometer have been produced, as part of the common shielding project. The chopper pit has been tested for assembly, albeit it not in the final position.

Detailed MCNPX calculations for the secondary spectrometer have been updated with the cave model and completed for the cave CTV document.

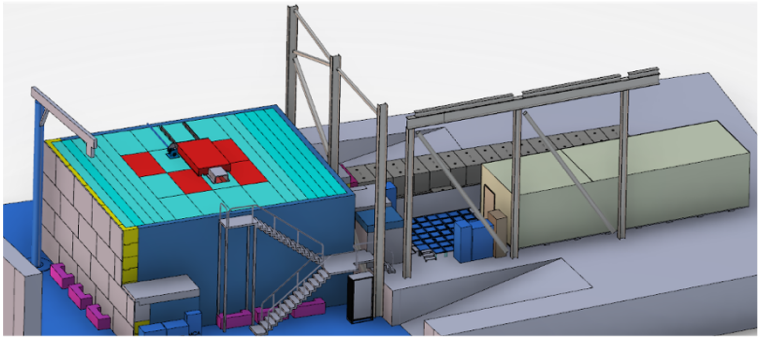
Figure 3. Shielding blocks of the chopper pit assembled during a test

Chopper

A detailed and fruitful KOM took place at the end of April. We received the models from Airbus at the end of June and started the revision of the chopper interfaces and guides. A PDR will take place on the 8th October 2021.

Cave and control cabin

A CTV document is almost ready for review, scheduled for early October. The document for the tender includes the cave, the control cabin and the local crane.



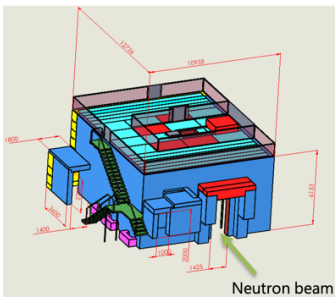


Figure 4. Overview of the cave (without the fences for clarity), the local crane and the control cabin area (left). 3D model of the cave (right).

Radial oscillating collimator
KOM with JJ-Xray in June 2021. An IDR is scheduled for 2021-10-07.

Detectors
The review of the detector vessels including the interface with CSPEC tank took place (2021-07-08). More details are outlined in the separate document for the detector overview. A test on a 1.5 m height vessel (to be used under the beamstop) MG detector, including i) the final grid design with the completed shielding and backplate concept, ii) the complete and final electronics and iii) the complete data acquisition chain, will be carried out at LET@ISIS in April 2022. The LET test will mark a fundamental milestone to decide about the full-scale production of the MG detector for CSPEC or the need of pursuing a plan-B for CSPEC detectors, with ^{3}He technology (*cfr* ESS-3638474).

Detector tank
A contract with SDMS was signed. The KOM will take place the 5th October 2021.

STAP COMMENT: The STAP would like to reiterate our earlier recommendation that all design decisions around the tank, cabling, rack space, data acquisition systems, etc., should leave open the possibility of a later operation of 3He tube detectors at CSPEC. This is because of the central importance of the detection system to the instrument performance and the persisting uncertainty with the multigrid detectors.
The design of the tank allows flexibility regarding the detector technology. However, some additional design work will be needed if we switch technology.

Data acquisition, transformation and analysis
The CSPEC team, in collaboration with the DMSC, are responsible for the data acquisition and analysis of the LET test. This will serve as a basis for further development.

We are working on the definition of the data format and data transformation path. (See report by G. Tucker). A workshop to discuss GUI possibilities and alternatives took place on 2021-08-31.

Instrument control software
We identified and outlined in a document the needed parameters for CSPEC-NICOS, organised in classes (expert and standard mode) and type (view only, view and modify…). Discussion with the DMSC is ongoing.

Sample environment
Agreement with the LLB to buy a 12 T magnet for spectroscopy. The cost is not within the CSPEC budget but is additional in-kind money from the French partner. The CTV document for the cryofurnace is almost completed. The CSPEC team had some meetings with the SAD group regarding the automatic sample changers. Currently no engineering support is available from SAD to push the project.

Safety
The personal safety system (PSS), oxygen deficiency hazard (ODH) and the instrument hazard analysis (IHA, conventional & radiation safety) documents are completed and ready for review.

Electrical installation
CSPEC is part of the common project, led by S. Birch. The main electrical cabinet has been installed. Detailed discussions re the rack positions are ongoing.

Utilities installation
CSPEC is part of the common project. Anton Lundmark is the new project leader.

Hot commissioning plan

The CSPEC team is working on an updated version of the instrument system validation plan document, which will serve as the hot commissioning plan document.

STAP comment: No delay due to COVID-19 is being mentioned.

Although the CSPEC team worked to minimise the impact (e.g., by keeping very frequent contacts among all the members, although mainly online), we had and may have further some delays in the design due to more difficult interactions, particularly for the cave design, and production for components such as guides, detector tests. We are also facing an increased components costs due to the pandemic. The true cost increases are however not yet fully known. Nevertheless, thus far no commercial supplier has declared delays due to COVID-19.