

Changes in SKADI Documentation after TG2 Review

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1. PURPOSE OF THE DOCUMENT

After the TG2 several changes to the documentation of the SKADI construction were recommended. This document allows tracking those changes.

2. RECOMMENDED CHANGES

The TG2 review committee recommended the following changes in the documentation:

- 1) The following changes are needed in the High Level Scientific Requirements (HLSR) listed in the presentation slides (S.10-11) and in system requirements p. 5;
 - a) Add a requirement for Q-resolution derived from the science case for high resolution science. This requirement should define dQ for a given Q range ($Q_{\min} < Q < Q_{\max}$)
 - b) SR#9 Properly define the S/B level for standard measurement (fully defined; e.g. by sample, q-range and resolution) The S/B level should be based on science case and the plan should be that this is achieved by the end of Hot Commissioning.
- 2) Add a shorter collimation option (e.g. 4 metre) for high intensity measurements.
- 3) Update the preliminary system design document with the new heavy shutter concept (i.e. located inside the bunker and based on the NSS standard).
- 4) insert a fast-acting cold neutron shutter out-side the bunker to be used to allow quick access to the sample area during routine operation
- 5) The design of access doors to the experimental cave needs to ensure efficient and safe access to the sample area for changing of Sample Environment Equipment, sample alignment and maintenance of the detector systems. The current design needs to be improved, this should be done in consultation with the ESS Science Support Systems team.
- 6) Correct the source point and trajectory from the peak of the cold moderator & reposition the instrument accordingly. Then provide a calculation of flux on sample

and brilliance transfer of the modified instrument, as a function of wavelength, and update the 3D drawings.

7) Provide proof (in the form of a quantitative analysis) that the current design (with 4 choppers) is the most cost effective way to meet the requirement for high resolution mode (see 1a) above), i.e. show that the cost/benefit is better than alternatives using longer wavelength neutrons or simpler chopper systems.

8) Provide proof (in the form of a quantitative analysis) that the current design (with 4 choppers) is superior to a design with fewer BW choppers (repositioned for best effect) and a frame overlap mirror. Include cost/benefit analysis in the proof.

9) Include ESTIA and LOKI as stakeholders in Concept of Operations

10) Include a place for a vacuum pumping station in the layout

11) In the Schedule and Milestones; a) all external milestones should follow the terminology and dates of the NSS definitions, b) add the in-monolith insert delivery date, c) add an early procurement approval milestone for each subsystem that needs it.

12) In the risk analysis in the work package specification, a) a number of the risk levels should be reviewed and adjusted b) mitigations should be revised to describe actual mitigations, avoid the term "use contingency" c) for all risks classed as "high", provide a more detailed description of the risk mitigation below the table d) Technical risk;

i) Add a heavy shutter reliability risk, particularly if it is planned for frequent use.

ii) The risk of FPGA failure in high neutron fluence is a concern. Add this to the risk table with risk rating and a mitigation strategy

e) Schedule risk; The risk of labour cost overruns is closely linked to completion date (TG5) for core project staff if their time is charged to the project regardless of progress rate. This risk currently has a high probability for SKADI because dates for installation and cold commissioning are earlier than anticipated in the NSS early science delivery plan. It may not be possible to provide installation resources in time for this completion date. This must be recognised in the risk rating and a mitigation strategy should be described.

3. PERFORMED CHANGES

The previously shown recommended changes to the documentation affected the overall documentation in several locations so as to keep it consistent. In the documentation the changes themselves are in red font in order to keep track of them easily.

The table below links specific changes to action items in the list of recommended changes.

Action Item	Affected Document	Description of Change
1 a)	Requirements	Page 5, changed requirement for Q resolution to SKADI shall provide a Q resolution of $dQ/Q < 15\%$ for $Q < 1 \times 10^{-2} \text{ \AA}^{-1}$ and $dQ/Q < 5\%$ for $Q > 1 \times 10^{-2} \text{ \AA}^{-1}$.
1 a)	ConOps	The science case is extended in an additional section (2.1 Science Case: High-Resolution) in order to illuminate the need for the HR setup
1 b)	Requirements	Page 5, changed requirement for S/N ratio to SKADI should be optimized to a signal to noise ratio (plateau of forward scattering vs. intensity value of vanishing fringes for a sample of dispersed spheres with a radius of 500 \AA) better than 10^{-4} .
2)	PSD	Page 21,22 Description for an additional 4 m collimation section is included
2)	Initial Ops	Page 9 Included section for financing of additional collimation distance from money saved from simpler shutter setup.
3)	PSD	Page 29, 30 Include updated description of heavy shutter according to ESS design standard
3)	Con Ops	Page 13 ff Include updated description of heavy shutter according to ESS design standard
4)	PSD	Page 29, 30

		Include description of a fast sample shutter
4)	WPS	Page 6 Include deliverable for sample shutter
4)	PBS	Include section for sample shutter 13.6.1.8.4
5)	PSD	Page 33 Clarification that access to the sample position has to be possible in a safe manner. Access possibilities and safety measures (rails and stairs) are described. Details will follow along with the new shielding standard.
6)	PSD	Page 11-13 Detailed simulation and comparison of different positions/orientation of the neutron extraction system are presented. Comparison of intensity at moderator surface and sample position is given.
7)/8)	PSD	Page 19, 20 Included comparison between several possibilities to improve the resolution.
9)	ConOps	Page 21 Included ESTIA and Loki as related instrument stakeholders.
10)	PSD	NEEDS TO BE VISIBLE IN FIGURE 1
11 a)	WPS	Using official designations as presented in NSS project corner
11 b)	WPS	Page 13 Included in-monolith insert delivery date
11 c)	WPS	Page 14 Included Early procurement milestones for Beam Extraction, Choppers and Beam Cut-off
12 a)	WPS	Page 21 ff

		Risk levels adjusted to be better comparable
12 b)	WPS	Page 23 ff "Use contingency" no longer used as mitigation strategy.
12 c)	WPS	Page 23 ff Detailed description for all risks with high severity included.
12 d i)	WPS	Page 22 Reliability risk for heavy shutter included
12 d ii)		Page 22 FPGA failure risk included
12 e)	WPS	Page 23 Moved risk for increased personnel costs due to longer project runtime from costs to scheduling. Included mitigation strategy description.