

## Neutron Chopper System TG2 Review ESTIA Instrument

### Review

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2016 TG2 Round for ESS Instruments

Technical Reviewer:  
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### Preamble

This document is the review summary of the instrument neutron chopper system preliminary design. Non-chopper systems aspects of the instrument design have not been considered, except where it is considered that they will significantly influence the performance of the chopper system under question (0 cases in this document).

### 1. Executive Summary

The reviewer considers that from the *perspective of chopper systems technologies* the preliminary design is sufficiently complete and mature to be considered for entry into the detailed design phase of engineering if accepted.

The overall system performance requirements presented in the concept appear to be technically feasible solutions that are endorsed by the NCG group.

Nevertheless, some risks have been identified but it is envisaged that they will be satisfactorily addressed/clarified in the detailed design project phase.

Therefore the reviewer grades the proposal: "GREEN".

## 2. Proposal Grading




The proposal is graded as a whole and by subcategory.






















For each item, a grade is given for the preliminary chopper design *as it stands now* (column "grade now"),

"GREEN": All aspects of the criterion have been addressed satisfactorily to permit endorsement by the NCG to the detailed design phase.

"ORANGE": Some aspects of the criterion have not been addressed satisfactorily. However, if additional information is supplied, NCG endorsement of the instrument to the detailed design phase may be possible.

"RED": Some aspects of the criterion have not been addressed satisfactorily and there are reasons to doubt they can be achieved without changes. Currently it is not recommended to proceed.

Grades are indicated as traffic lights:  = green,  = orange,  = red.

Criteria	Project	Mechanical Integration	Control Systems Integration	Technical Feasibility and Neutronics
Overall				
Maturity				
Compatibility				N/A
Feasibility				
Risks				
Budget completeness		N/A	N/A	N/A
Schedule		N/A	N/A	N/A

### 3. Currently identified issues

“A red classification requires a detailed explanation of the reasoning.”

**Maturity:** The requirements need to be expanded but are sufficiently detailed to commence the detailed design, engineering phase.

**Compatibility:** The requirements of the system are in full compatibility with the ESS neutron chopper systems requirements documentation.

**Feasibility:** The overall system performance requirements presented in the concept are technically feasible solutions that are endorsed by the NCG group (horizontally split enclosure) with further customisation required (enclosure bottom section integrated with the virtual source VS and collimator). The complexity of the system outlined in the base proposal is low (single chopper) however the integration with the VS and collimator can pose difficulties (packing, vibration migration from the chopper to sensitive devices). An envisioned implementation of an active magnetic bearing technology potentially provides a reduction of vibration in the relatively slow speeds but this should be further investigated.

**Risks:** The principal risks related to chopper system are operational in nature - ensuring that installed system is reliable and can be maintained. These issues are considered achievable if addressed early.

The chopper performance requirements (low speed, standard disc size) are low demanding and can be described as standard. The potential supplier (Mirrorton) is considered as experienced in this type of choppers. The bearing system is based on the tested SKF magnetic technology with low maintenance required.

The major concern is the integration of the chopper assembly with a decoupled VS and collimator. It seems to be feasible but the cautious approach should be applied during the detailed design to provide an adequate solution to avoid potential vibration influence from the chopper.

Another concern is the remote clamping/positioning system for the horizontally split enclosure (standards under development at NCG). The frequent communication with NCG is advised during a detailed design.

**Budget completeness:** The total cost indicated for the chopper systems is considered realistic. The value of the groups' deliverables is not a significant (~5-10% of total) proportion of the concepts budget. The estimated hardware supply costs of ~0.145M€ (125k€ + 20k€) seems to be reasonable considering the integration with the other components (customisation of the chopper bottom section – vacuum box). The estimation of the labour (~0.054M€) also is realistic.

**Schedule:**

The timeline for the realisation of the groups' deliverables appears realistic and the estimated detailed design phase duration is ~9months (DES Q3 2017) and a delivery ~18 months (COM Q1 2019). The groups' deliverables are not on the projects critical path. An early procurement approach should be sufficient to secure the scheduled chopper assembly integration.

**Reliability:** The proposal is broadly compatible with the deployment of standardised chopper systems to ensure high reliability (e.g. utilisation of the magnetic bearing technology with monitoring system). However a special effort is required to provide the high reliability of the closely integrated SV and extraction concept, which can potentially require a joint extraction with the chopper assembly as well.

**Availability & Serviceability:** Chopper unit is installed in BLACK access zone.

Access to chopper systems in BLACK zones will not be possible during neutron production and should be high reliability unit. Serviceability and access of the chopper assembly at 11m will pose difficulties in the bunker.

**Development:** A customization/integration with other systems (VS, collimator) of the bottom section of the chopper assembly (horizontally split enclosure) is envisioned and included in the planning.

#### **4. Detailed/other comments**

##### **Instrument Space Conflict**

The instrument line is located in the E2 beam-port. Currently there is no potential conflict with neighbouring lines recognised. Even if SKADI or ANNI instruments are considered as potential neighbours, there is no interference visible with the chopper assembly surroundings.

However there is a collision/interference recognised with one of the bunker braces utilised to support the ceiling pillars in current bunker design. The new bunker concept is under development and can potentially solve chopper assembly-brace interference by abandoning the brace concept in general. Another possibility is to customise/redesign the bottom section of the assembly (vacuum box) to avoid interference.