

## Neutron Optics and Shielding Group TG2 Summary VESPA Instrument

### Review

Date  
9<sup>th</sup> October, 2017

2017 TG2 Round for ESS Instruments

Technical Reviewer:  
Phil Bentley

Input received from  
Douglas DiJulio  
Damian Martin Rodriguez

#### Preamble

This document is the review summary of the instrument's optical and shielding system preliminary design. Systems outside of this scope have not been considered, except where they significantly impact on optics and shielding.

#### 1. Executive Summary

The reviewer considers that from the *perspective of optics and shielding systems* the concept of the design is sufficiently complete and mature. However, there are significant deficiencies in working practice and risk assessments.

#### 2. Proposal Grading

The proposal is graded as a whole and by subcategory.











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


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

"ORANGE": Some aspects of the criterion have not been addressed satisfactorily. However, if additional information is supplied, NOSG 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.

Criterion	NOSG Status	Comments
Has adequate planning been done to move the project into Phase 2?		
Is the proposed budget consistent with the proposed scope?		
Does the preliminary design satisfy the requirements?		
Is the presented baseline technically sound?		
Has anything been forgotten or neglected?		
In case where several In-kind partners are collaborating – are roles and responsibilities adequately defined and agreed?		
Have safety-related aspects in accordance with ESS-0043330 ref [6] been appropriately considered?		
To what extent have appropriate connections been made with the critical project interfaces, such as software, data storage hardware and sample environment?	NA	
Has the instrument context been appropriately considered in terms of physical interfaces, such as bunker, beam extraction, ICS etc?		
To what extent have available engineering standards been implemented appropriately?		
Are the cost and duration estimates reasonable?		We feel that the concept errs on the cheaper side of the cost-benefit balance, and a modest increase in cost would have a significant increase in guide performance.

Criterion	NOSG Status	Comments
To what extent has the team planned appropriately for the risks, both technical and otherwise?		

### 3. Currently identified issues

#### Optics

In the PSD they refer to an Optics report that it is not included in the TG2 documentation. Probably is the one we reviewed few weeks ago, but we have asked Clara to ask them to include this report in the TG2 documentation. It is our understanding that this has been included now, so we could say that they have followed our checklist as they have discussed different optical choices at least in performance and cost, and they have included the simulation files.

There is a typo as they say that they will use borofloat for its superior lifetime qualities. However, in the report they sent us they said specifically they would use borkron, so we assume this is a typo.

We think the main concern is the performance, which is comparable to the existing instruments. In their choice of optics, cost has been a very important driver (much more important than the obsession for more neutrons that other instrument scientists have had), and they have decided for a cheaper option than the one having other systems with a gain of up to a factor of 2.5 over their chosen baseline (and therefore a factor of up to 2.5 over the existing instruments). This may be a source of controversy in the TG2 review as it happened with BEER. From our side, we do not object if they don't want to spend more money in their guide, but the cost-benefit ratio feels to us that it may be in their interest to increase the performance. We offered to do a study similar to the one we did with MIRACLES, but they declined. This offer still stands if they want to consider it.

VESPA team has had good communication, and have done a good work on keeping us updated with their current work, and this is something that has been very rare during all the TG2 reviews. This has been promoted by Clara, as the integration engineer who has been around trying to keep that communication between us and the instrument team. Both VESPA and Clara should be praised for their willingness and enthusiasm to maintain a good communication flow.

In summary, we would say they have done all (or almost all) of what it was required from us (which is more than what many approved instruments have done). We don't entirely agree with their cost-benefit choices, but there are no showstoppers and they have followed our checklist.

#### Shielding

The shielding along the guide has been looked at with first the NOSG cost process and then they have presented some early MCNP calculations which suggest reduced shielding. Our only recommendation is to make sure to consider the photon production in the m=4 guides and substrates in the further optimization. The MCNP calculations do not include this component and they are aware, but we think it's good to re-enforce this point.

Some thicknesses are provided for the cave shielding, however it is not clear how they arrived at the result. Some more detail would be good and a calculation of the worst case photon sample and neutron case (since they are straight) would be good to see.

The heavy shutter design currently has tungsten in it, however this is not on the list of accepted materials for use in the bunker. ESS is not space limited. NOSG standardised on copper collimators after an evaluation of cost, performance, activation and waste. Our recent interactions with RP and Waste experts have reinforced this position. Any other material either increases the waste footprint; or increases the activation in the bunker on the < 1 week timescale, increasing the dose rate to the technical staff who will do maintenance work.

The current design of VESPA includes a fast neutron collimator block before the shutter system, however its purpose appears to be for background reduction. It is clearly indicated that the bunker is an ESS task and the team states that they only will provide boron carbide shielding around the guide. If ESS management changes the shielding strategy then this project will need to be updated.

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

##### **Addition During Meeting**