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LoKI Staging Plan

SUMMARY

The purpose of this document is to describe how the instrument performance will be upgraded over time after the construction project to get from the baseline scope to the full scope as envisaged in the instrument proposal.

The baseline scope is summarised and the staging and upgrade options are presented

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1. OVERVIEW OF BASELINE

The top level requirements for LoKI [1] define the target scope for the instrument construction project. They have been formulated to capture the key aspects of the instrument proposal science case and are :

1. The instrument shall allow data to be collected to a Q_{min} of < 0.001 $Å^{-1}$.
2. The instrument shall allow data to be collected to a Q_{max} of > 2 $Å^{-1}$.
3. The instrument shall allow data to be collected simultaneously over a continuous Q range with Q_{max}/Q_{min} > 1000.
4. The instrument shall match the size of the neutron beam to the size of the sample.
5. The instrument should allow the Q resolution (dQ/Q) to be optimised for the experiment.
6. The instrument should be capable of providing a Q resolution < 10% dQ/Q between 0.001 $Å^{-1}$ and 2 $Å^{-1}$.
7. The instrument should allow data collection from samples < 8 mm^3 volume
8. The instrument should maximise the signal-to-background (S/B) ratio of the small angle scattering.

The instrument baseline is described in the LoKI work package specification. In summary the scope consists of :

- 2x line of sight benders, long wavelength cut-off mirror
- Collimation lengths of 2m, 5m, 8m and 10m selectable.
- Bandwidth and frame overlap choppers
- Infrastructure installed to allow resolution enhancing choppers
- Core sample environment suite (sample changer, cells and flow cell)
- Window frame style detector geometry:
  - 2x1m 15mm resolution at 1.4m from sample, offset
  - 2x1m 8mm resolution at 5m from sample, offset
  - 0.5x0.5m 3mm resolution moveable between 5m and 10m from sample
- 3.5m diameter vacuum vessel for above
- All necessary associated infrastructure (shielding, cabling, cabins etc)

As part of detailed design, an alternative detector geometry - the "barrel type" detector [2] will be developed in parallel with the design of the window frame detectors as this presents the possibility of delivering the same angular coverage of detectors at lower cost.

2. STAGING OPTIONS

Any unspent budget contingency, or underspend of any kind, will be used to enhance the scope of the instrument. It is unlikely that these will be large sums and so the most likely use is for additional sample environment.

2.1. Resolution Enhancing Choppers

Adding the resolution choppers would cost around 400 k€. Given that this upgrade has clearly defined performance enhancement, it is something that we envisage obtaining from external funding.

2.2. Detector Coverage

The two front detectors can each be increased in size to 2m x 2m to increase the instrument performance, in particular for studies of oriented samples.

This additional fit out of the remaining window-frame detector coverage, as foreseen in the proposal, would cost approximately 1.5 M€ on the assumption that while detectors would be cheaper by then, but there would be additional manpower costs for restarting work. This could be paid for from operations budget and/or external grants and can be done in stages, fitting out a subset of detector panels as determined by the availability of funds.

The barrel detector concept also allows for the fitting of detector modules as funds become available. A costing for that staging will be developed in 2015.

2.3. Sample Environment Equipment

Sample environment will eventually be an extensive set of equipment. This will be paid for from an on-going programme using a combination of operations funds, external grants and collaborations with users.

3. REFERENCES

1. System_Requirement_Document_13.6.3_LoKI

2. Kanaki, K., Jackson, A. J., Hall-Wilton, R., Piscitelli, F., Kirstein, O., & Andersen, K. H. (2013). A novel small-angle neutron scattering detector geometry. *Journal of Applied Crystallography*, *46*(4), 1031–1037. doi:10.1107/S0021889813011862