

PAUL SCHERRER INSTITUT



WIR SCHAFFEN WISSEN – HEUTE FÜR MORGEN

M. Strobl - Applied Materials Group :: Paul Scherrer Institut

## HighNESS – WP 7 Condensed Matter Science

GA Kick-Off Oct. 2020

markus.strobl@psi.ch



# WP7 – Condensed matter science

<b>Work package number</b>	7	<b>Lead beneficiary</b>				PSI	
<b>Work package title</b>	Condensed Matter Science						
<b>Participant number</b>	1	2	3				
<b>Short name of participant</b>	PSI	ESS					
<b>Person months per participant:</b>	18	18					
<b>Start month</b>	1			<b>End month</b>	36		



## Objectives

There are three high-level objectives to this WP:

1. Assemble an instrument suite for condensed-matter science viewing the ESS lower moderator
2. Evaluate the optimum configuration of the moderator-reflector system and instrument designs which achieves the best performance over the full set of instruments.
3. Quantify the instrument performance of that configuration, so as to provide a basis for estimating the scientific impact of such a facility.

# WP7 – Condensed matter science

**Task 7.1** Definition of instrument concepts for the study. For each of the three instrument types, ideas for particular instrument concepts will be developed by the experts in each field. It is expected that for each instrument type, there will be 2 or more instrument concepts which the experts will consider to be sufficiently promising that they may produce game-changing performance after due optimization with the appropriate neutron source characteristics. The selection of concepts will be based on their performance potential as well as a rough estimate of their corresponding potential scientific impact. **PSI, ESS (M1-6)**

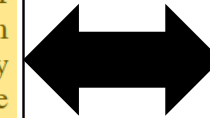
**Task 7.2** Definition of Figure of Merit (FoM) for each instrument concept. This is primarily the work of the expert in each field, and it is expected that the FoM will be defined differently for each instrument concept. Careful definition is required, as it will bias the subsequent optimization process. There will necessarily be some overlap in time between this task and the next, as any shortcomings in the initial definition of the FoM

will become apparent as the optimization work is started and may result in adjustments to the FoM definition. **PSI, ESS (M6-12)**

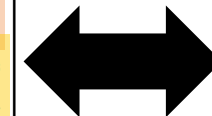
**Task 7.3** Optimization of the performance of each instrument concept in collaboration with WP4 (moderator neutronics) and WP6 (advanced reflectors). This represents the bulk of the work. It will primarily be performed by early-career scientists with experience in instrument design by Monte Carlo methods, supervised by the instrument experts and working very closely with WP4 and WP6.

An initial geometry and spectral distribution from the moderators and the reflector will be provided by WP4 and WP6, respectively. This will allow the optimization of each instrument concept to those parameters, defined as the instrument setup which maximizes the FoM, and establishing a baseline performance. In the next iteration within this task, an estimate of the variation of the spectral brightness as a function of the geometry and composition of the moderators and reflector will then need to be provided by WP4 and WP6 and will allow a series of re-optimizations of each instrument concept. Each iteration will feed back to WP4 and WP6 and drive the direction in which those design efforts should move. It is expected that this will take up about 36 man-months of effort between ESS and PSI, distributed over a period of two years, in addition to the time needed for the instrument experts to supervise and coordinate the work. **PSI, ESS (M6-30)**

**Task 7.4** Global optimization of instrument concepts. This entails the bringing together of the individual instrument-source optimizations into a single global optimum, determining the combination of moderator and reflector systems which best serves all the instruments viewing the lower moderator. It will result in a quantitative calculation of the performance of all the instrument concepts which can be used to establish the overall scientific impact. **PSI, ESS (M30-34)**



**WP4  
Mod  
desig  
(WP5 & 6)**



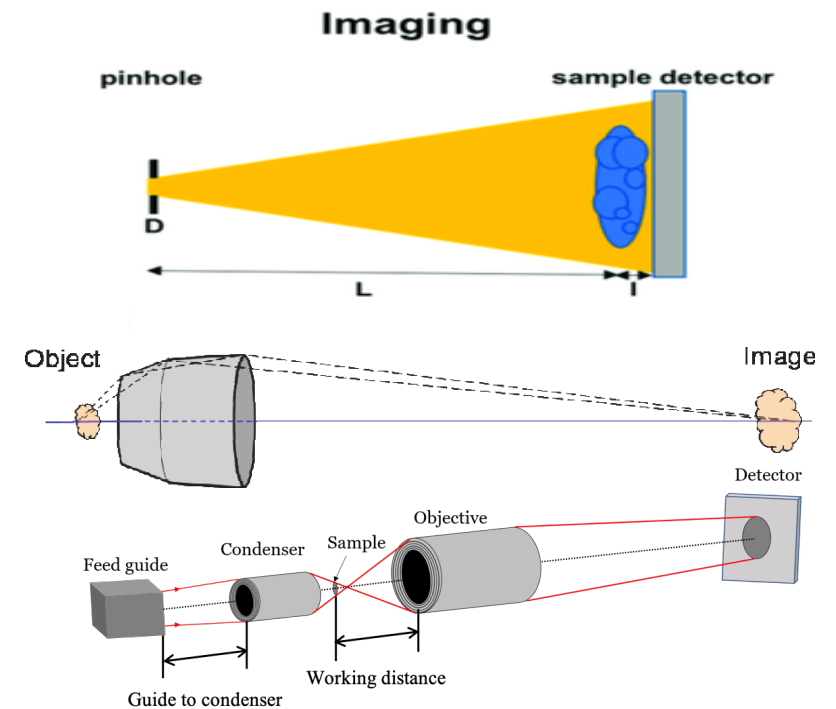
**WP4  
Mod  
desig  
(WP5 & 6)**

**Deliverables****D7.1 Definition of instrument concepts (M6)**


This report is the main output of Task 7.1 and will be delivered in month 6. It will list the instrument concepts selected for optimization, together with a brief justification for their selection and a preliminary definition of the FoM for each instrument concept.

**D7.2 Optimization study of instruments, moderator and reflector (M34)**

This report covers the work of Tasks 7.2, 7.3 and 7.4 and will be delivered in month 34, marking the end of the WP. For each instrument concept, it will describe the FoM used for the optimization and the iterative optimization process involving moderators, reflector and instrument design. It will then assemble the optimization of all the instrument concepts into a single global optimum and evaluate and present the resultant instrument concepts and their performance. For an example of a similar optimization effort, see Ref.<sup>4</sup>



## WP7 – Status Summary

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- A solid grey square is positioned to the left of the list of bullet points.
- PostDoc hired
  - familiarisation and conceptual design work started
  - Critical contacts to other WPs established
  - Requirements exchanged
  - 1<sup>st</sup> communication with stakeholders for  
ESS instrumentation/SANS established
  - Facility boundary conditions considered
  - Strategy for further contacts made (SE, McSTAS, Wolter)
  - INS, NR to be considered in addition
  - Fully on track
  - First 6 months critical
  - Tbd: establish plan with Mads

Thank you!

- Questions?

