

Neutron scattering models and nuclear data at ESS



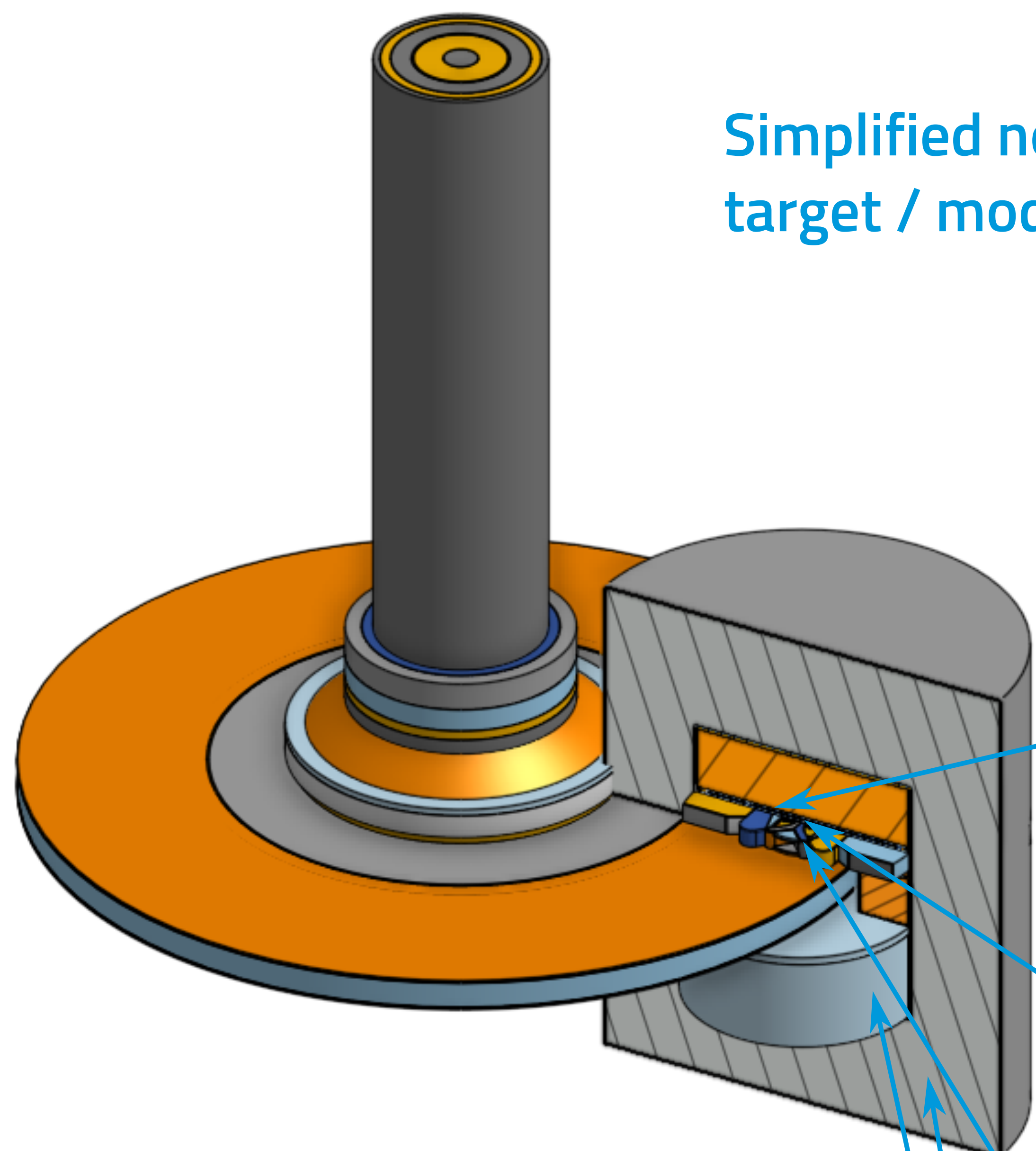
Márquez Damián J.I.*; Di Julio, D*; Kittelmann, T[‡]; Muhrer, G.*

* Spallation Physics Group, European Spallation Source ERIC, Sweden

‡ Data Management and Scientific Computing, European Spallation Source ERIC, Denmark

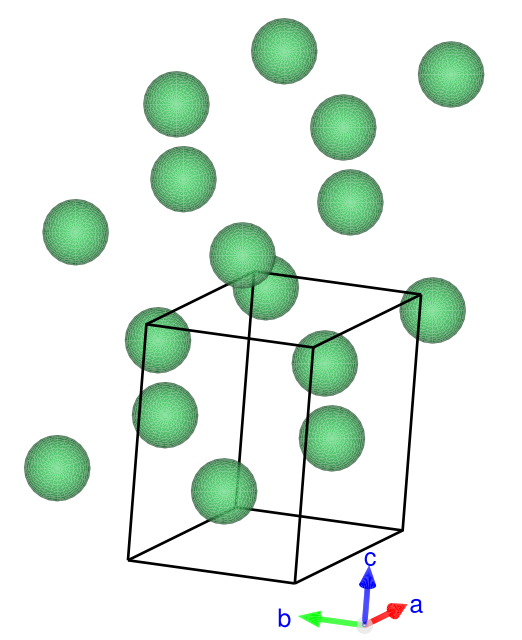
The Spallation Physics Group (SPG) supports the construction of ESS by providing expertise on radiation transport, material science, shielding design and radiation physics. The SPG also conducts research on topics relevant to its area of competence. In particular, the SPG leads the development of low energy neutron interaction models for radiation transport, in collaboration with the ESS Data Management and Scientific Computing center and groups around the world.

The focus is on materials of interest for the production of neutrons: neutron moderators, reflectors, filters, and structural materials. Over the past years this line of work has included the development of theoretical models and software, as well as neutron scattering experiments for material characterization and model validation. These models can be used for the improvement of neutron scattering instruments and the interpretation of experimental data, particularly within the field of wavelength - dependent neutron transmission.



Simplified neutronics model of the target / moderator / reflector assembly of ESS.

Beryllium: updated model with extinction effects, taking into consideration the microstructure of different material suppliers. This analysis is now an international standard in the JEFF 4 nuclear data library.

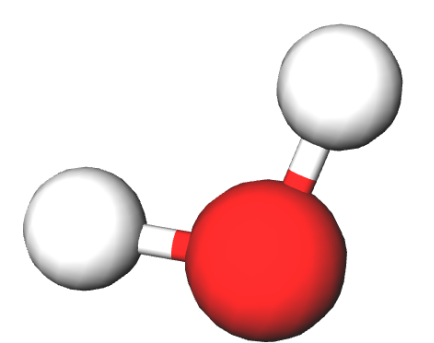


Reflector materials



Beryllium extinction

Light water: updated model with continuous temperature dependence. This model is an international standard in the JEFF 4 and ENDF/B-VIII.1 nuclear data libraries.



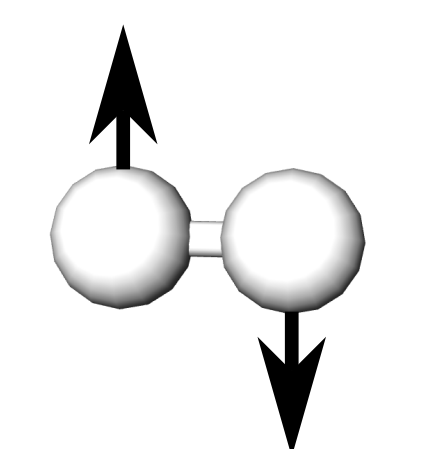
Nuclear data development



CAB Model update

Structural materials: NCrystal allows to easily create scattering models for solids, and export them to the ENDF-6 standard format using ncrmat2endf. ESS has contributed 65 new and updated ENDF-6 files to the JEFF 4 nuclear data library.

Liquid hydrogen and deuterium, both in their para- and ortho- forms: new analysis based on path integral molecular dynamics, with contributions of Master's students from Lund University. This model is available as an international standard in the ENDF/B-VIII.1 nuclear data library.



Liquid hydrogen and deuterium



Aluminum windows



NJOY+NCrystal



ncrmat2endf



Solid deuterium



Graphitic compounds



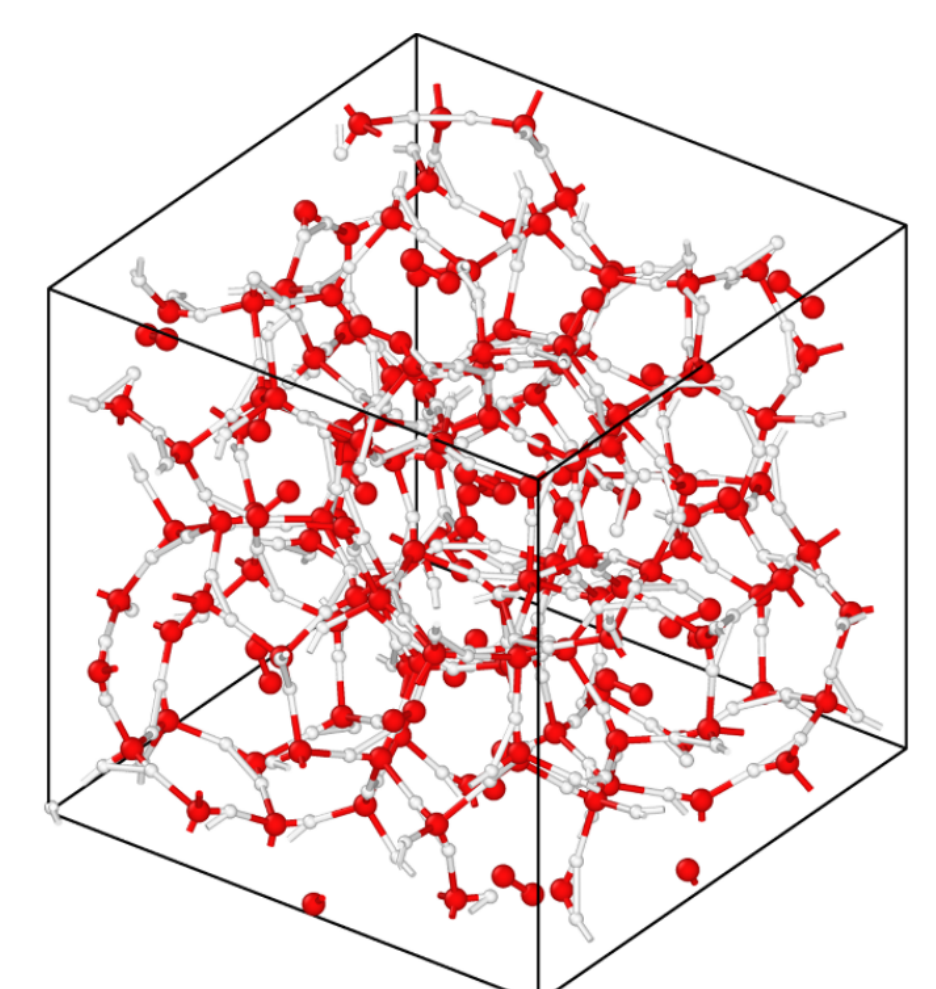
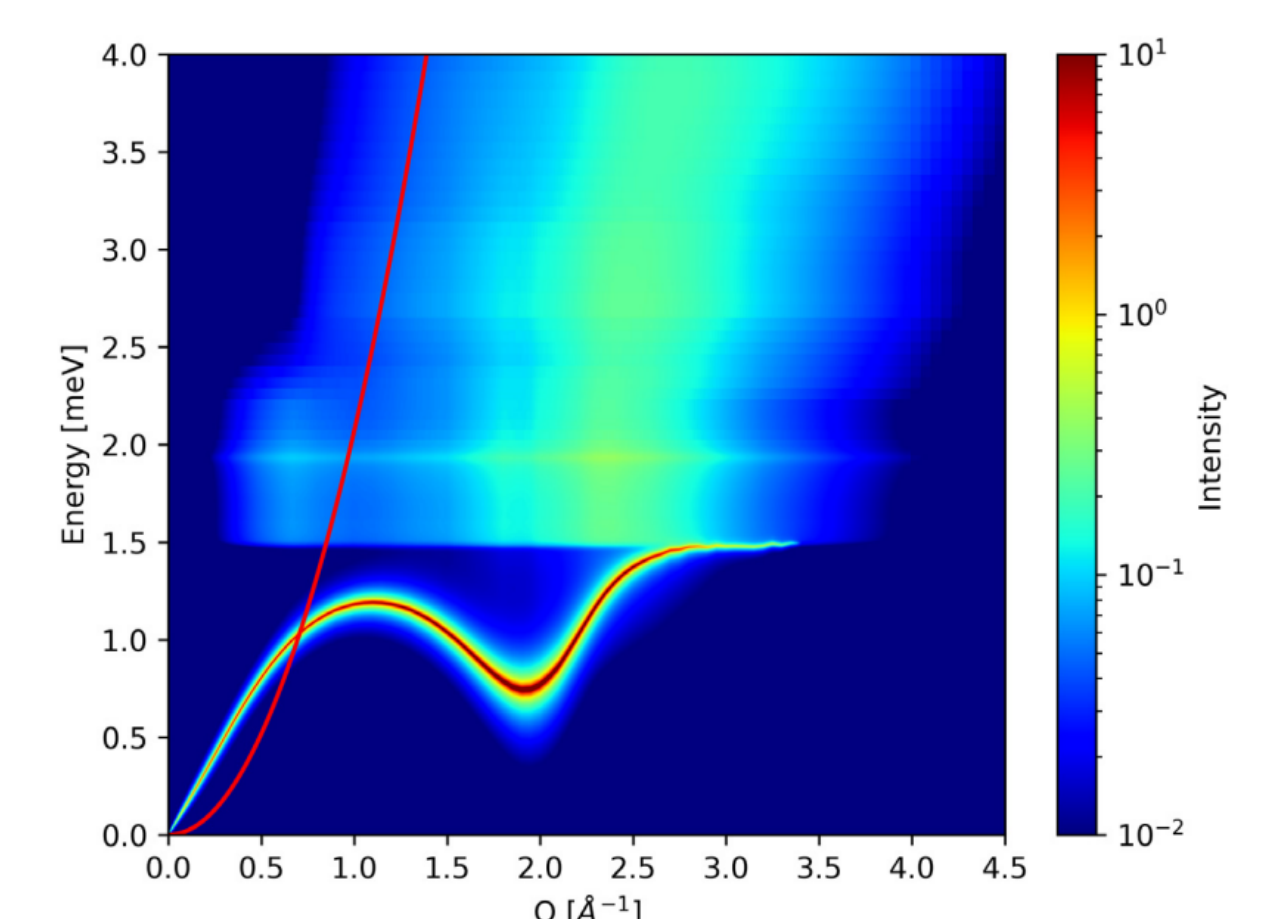
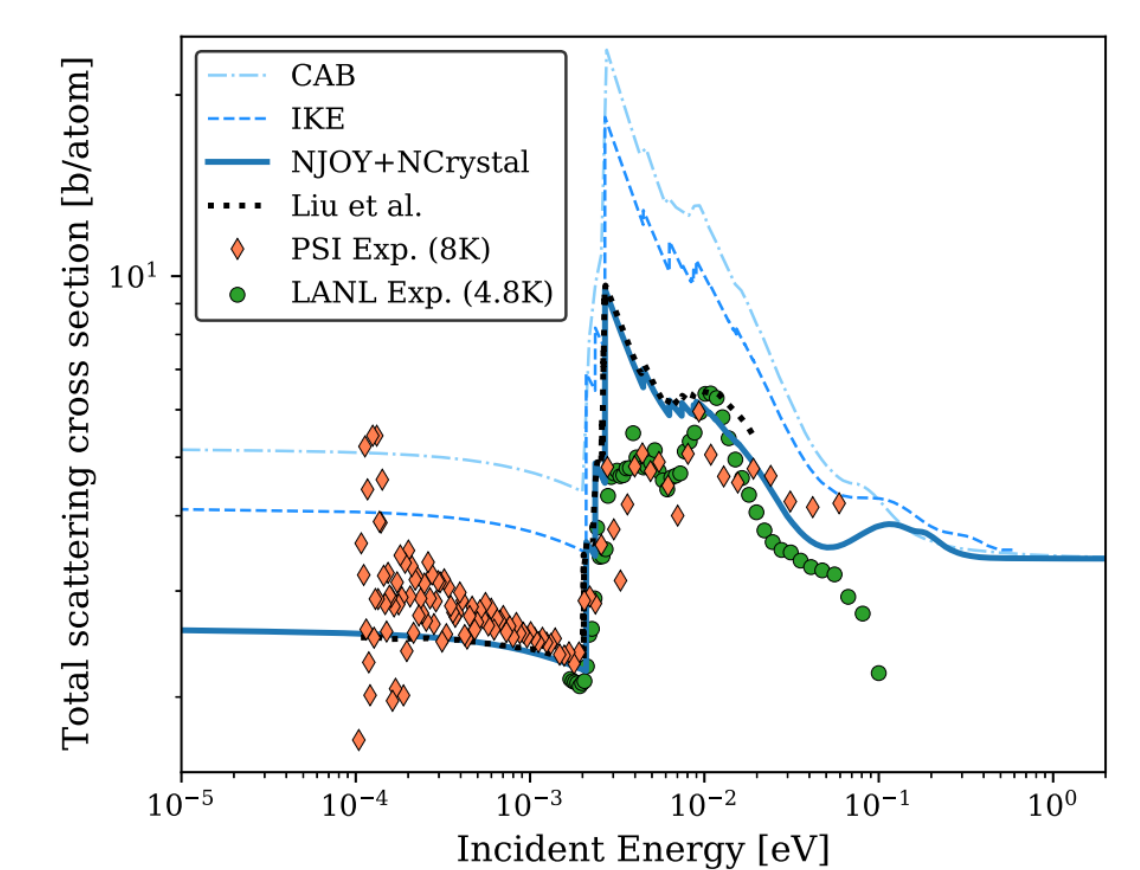
Superfluid helium



Diamond nanoparticles



Oxygen hydrates



HighNess

Conceptual design study for the development of a high intensity volumetric source at ESS. This source would complement the current high brightness light water / para-hydrogen moderator and it is planned to be located below the target wheel, replacing the current steel reflector. In connection to this project, several new and updated models were developed to study different alternatives for the production and delivery of cold, very cold and ultracold neutrons.

References:

Scan the different QR codes to read the papers on specific developments.

